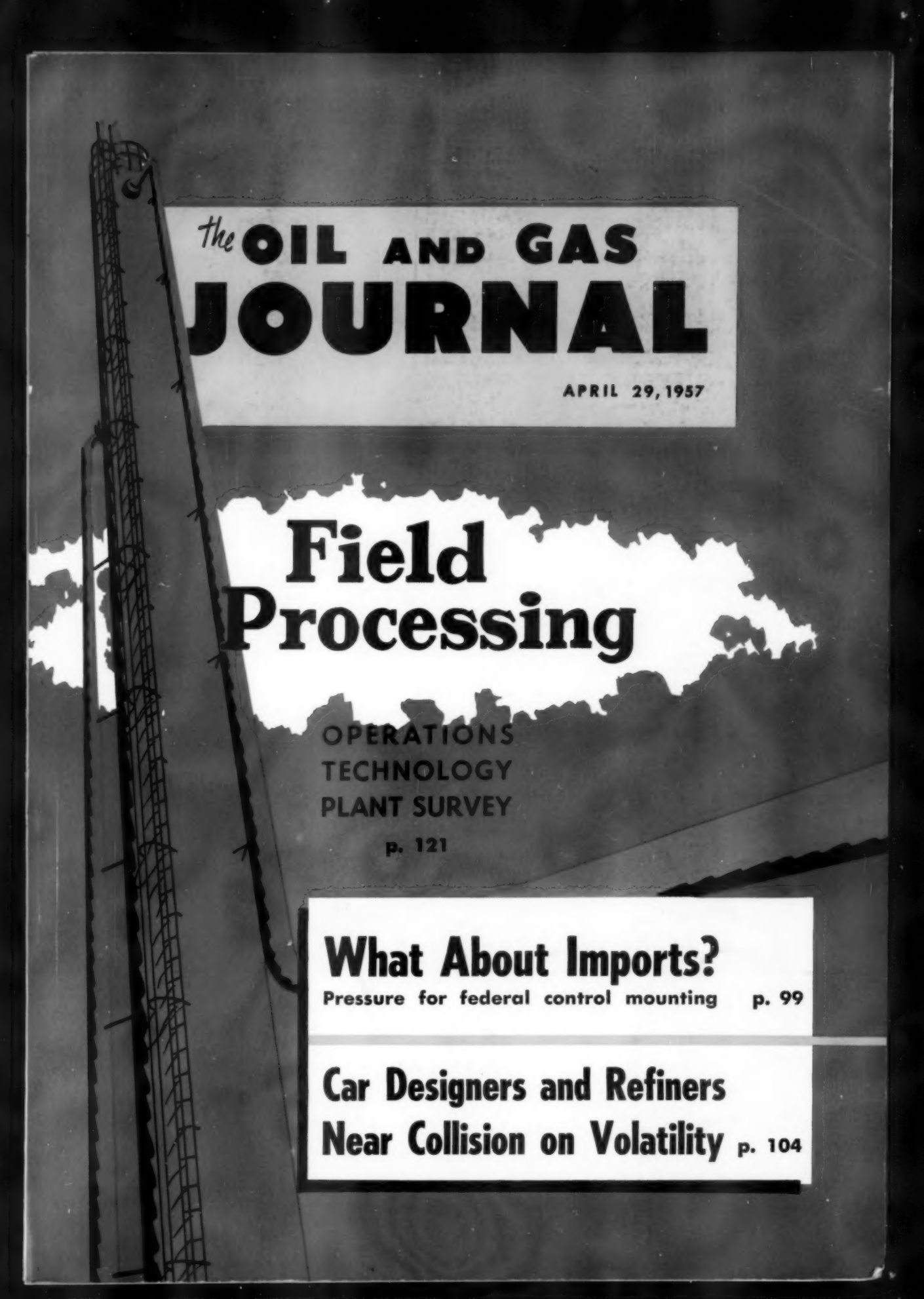
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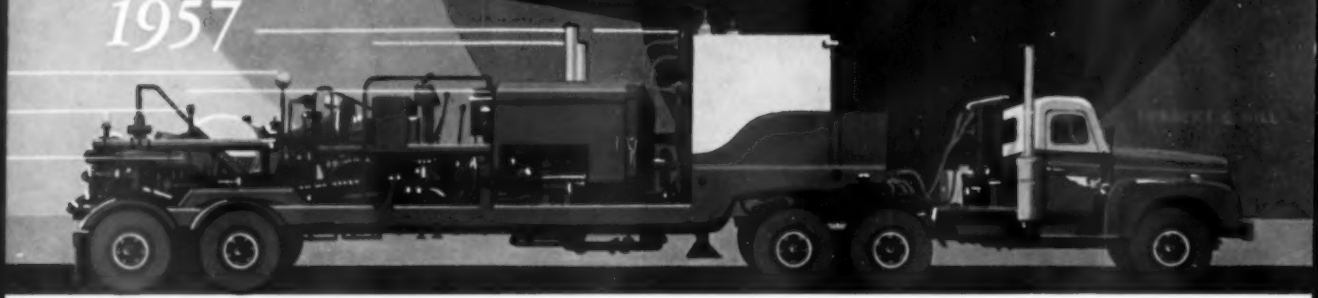

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JOURNAL News Letter

April 29, 1957
Tulsa, Oklahoma

The imports pot is beginning to boil:

Sentiment is growing among independents that the time has come to press Congress for definite controls on foreign oil coming into this country. These men are convinced voluntary controls won't work. They fear a vacillating period is coming up until Mobilization Boss Gordon Gray makes up his mind on the issue. The outlook: Nothing but trouble in months ahead if this policy is continued (P. 99).

Many independents express a distaste for government controls in any form. But they feel the domestic industry now has no other choice if it wants to keep solvent and that imports control doesn't necessarily mean full control of the domestic industry.

All this makes the current Biloxi convention of I. P. A. A. the most important in years. The whole issue is getting a thorough going over. A plan of action is expected to emerge from a post-convention session of representatives from 19 domestic oil and gas associations.

LABOR. Top leaders of O. C. A. W. face tough decision: Accept oil management's offers of 5 per cent wage increases or call strikes in the industry. After 4 months of pressing for a 27-cent hourly boost, O. C. A. W. has received no offers higher than 13-1/2 cents, about 5 per cent more (P. 102).

Union chief Knight says powerful bargaining-policy committee will meet soon to take a hard look at the facts. It will decide whether to call a strike to attain the union's terms. Best bet: Labor will take half a loaf rather than strike this time.

STEEL. Softening of some parts of steel market is good news to oil industry. A cutback in automobile production, wire rope, and wire is freeing ingots for pipe mills. They previously hadn't been able to get enough steel to operate at capacity.

Tonnage isn't sufficient to change long-term picture: Most mills are booked up through 1960. But the immediate supply situation is altered. Chief example is Four Corners Pipe Line from Utah to Los Angeles. It will be built with automobile steel. Also, small-diameter buttweld and continuous

weld pipe are now available from some mills out of stock.

TAXES. One thing to remember in current attacks on U.S. tax position of American oil companies operating abroad: Oil is treated no differently than other American business with foreign operations. Aramco made this plain in a straight-forward answer explaining its tax position to senatorial critics.

PRODUCTION. Threat of overproduction, a chronic pre-Suez problem, is haunting the prorated oil states again. For instance:

...Texas is finding its production ebbing with dropping demand. Areas where pipeline proration has been chronic in past 2 years again are becoming trouble spots. Railroad Commission last week lopped 70,173 bbl. daily off permitted flow for May. It set only a 16-day producing program for the month.

...Louisiana reports crude orders designed to help the European oil lift are being cancelled. As result Louisiana's allowable for May was put at 883,318 bbl. a day or a cut of 36,095 bbl. under April. At height of Suez crisis, Louisiana was producing all-time record of nearly a million barrels daily.

...Oklahoma is bucking the trend and is keeping the April per well basis for May's allowable. Actually it will result in a 3,000-bbl. increase. But the action came in face of spotty marketing problems and a request for cut from crude buyers.

Kansas producers are facing a tougher set of antipollution statutes. Laws were passed by the 1957 legislature, which also imposed a 1 per cent severance tax. The new rules require surface casing, prohibit salt-water storage in open ponds, and set a minimum depth for salt-water disposal wells. Independents fear that too stringent interpretation of the rules by a state agency will force many marginal wells to shut down.

Speaking of marginal wells, bottom-hole heaters are putting new zip into these small producers in California. Use of heaters has jumped 200 per cent in 2 years. The majors now are taking the lead away from small operators in installing the systems. Hot-water circulating types are more popular for shallow wells. The deeper ones--up to 4,000 ft.--are electrically heated. The process has averaged adding 10 bbl. daily to production of wells where it has been installed (P. 106).

DRILLING. "Mr. Gus" didn't just fall. He was pushed. Detailed report by owner of the giant mobile drilling platform which toppled in the gulf April 3 says: A crane barge was anchored upwind from "Mr. Gus" to serve as a breakwater. The anchor chain broke, and the barge drove into the drilling platform. That set off a tragic series of events ending with "Mr. Gus" keeling over 4 hours later.

Role of helicopters in offshore drilling is growing rapidly. These versatile air buggies are whipping the shore-to-platform transportation bottleneck. Humble's experience shows the trend: Its fleet of 13 helicopters logged 38,000 flights last year and in February this year alone shuttled 12,000 passengers to offshore locations. Humble plans to add two more planes immediately.

Contract drilling in Venezuela is attracting a newcomer--Kerr-McGee. The Oklahoma-based firm will have two drilling tenders available for Lake Maracaibo work late this summer. Both already are under contract.

Insiders claim a big rush of drilling equipment to Venezuela won't develop for several months. Land rigs are reported in ample supply there at present, and offshore equipment is sufficient to take care of the wells in sight. But a few good discoveries on new concessions could change this demand for rigs quickly. Other stateside drilling firms are reported preparing to move in.

EXPLORATION. Prospects are good for the confirmation well in the new Northeast Hallsville pool in central Harrison County, East Texas. The offset, Amerada's 1 McBrayer, flowed at rate of 800 bbl. daily on test in Crane zone of the Pettet at 6,910-68 ft. The pool was opened last December by Amerada's 1 White. Offset was staked 3/4-mile southwest of the discovery.

Gulf Oil's former partner in Italy, the Montecatini chemical interests, has completed a well in Cigno field. It's the first completion since Gulf pulled out of Italy. Completion is in a second pay zone which is more than 300 ft. deeper than Gulf's discovery well early in 1955.

REFINING. Watch for the problem of gasoline volatility to reach a showdown soon. Refiners and auto makers may be forced to work out a joint solution.

The situation is this: Refiners are increasing the vapor pressure along with octanes in their gasolines. But Detroit designers are turning out cars which are getting more and more allergic to volatile gasoline. High temperature under the hood, which has been lowered and jammed with extra accessories, is the villain. To offset this, auto designers have vented the carburetor. This has caused gasoline waste. It means the engine isn't getting all the gasoline the motorist put in the tank (P. 104).

Some refiners are pinning hopes on fuel injection to relieve the volatility problem. But there are two hitches to this: No gains could be realized until all the carbureted cars were worn out. Besides, consensus now seems to be that fuel-injection systems will be as limiting on volatility as present-day carburetors.

There's also talk of reducing butanes in motor fuel to alter volatility. This is doubtful and need not alarm natural-gasoline manufacturers, for this reason: The petrochemical demand is expected to keep the butane market firm. Besides, for some refiners the price of propylene for chemical manufacture may soon equal or exceed the realization from polymer gasoline. In the long run, both natural-gasoline processors and refiners would do well to consider maximum C_3 recovery. The market looks good from here on.

Natural-gasoline plants in the U. S. increased production 6.6 per cent last year, The Oil and Gas Journal's annual field processing survey shows. Total production was 31,237,135 gal. per day on January 1, 1957. Cycling plant production dropped slightly from the previous year. It averaged 6,521,504 gal. daily. A special section on the growth and technical progress in field processing starts on page 121.

New plastic pipe, called completely different from anything before, has been introduced with an eye on a market in oil and gas fields and processing plants. It is fabricated by Orangeburg Manufacturing Co. from a new low-pressure, high-molecular-weight polyethylene resin made by Allied Chemical & Dye. Pipe is said to have superior strength and high resistance to impact, heat, and chemicals.

PIPELINING. Natural gas suddenly has popped into the news in California. Beehive Bend-Willows gas field in northern California soon will have two new north and south outlets to market. Pacific Gas & Electric is planning an 83-mile line and gathering system south from field to Sacramento and a 173-mile line from Corning to Humboldt County in the north. A present line connects the field with Corning.

Owners of mineral rights in Rio Vista field, California's largest gas reservoir, are suing nine companies for $150 million. They charge a monopoly is working to depress sales of Rio Vista gas in favor of fuel imported from out of the state.

Crude pipeline linking the promising British Columbia oil region with the Pacific Coast at Bella Coola, north of Victoria, is in the mill. Act Oils, Ltd., subsidiary of Canada Southern Petroleums, is seeking permit for the 450-mile route. British Columbia now only has 1,000 bbl. daily production. But there are nearly 27 million acres under lease in the region. Phillips Petroleum is now actively exploring 1,367,000 acres farmed out from Canada Southern. Such an ambitious pipeline program should indicate the operators have some promising evidence on the region's oil potential.

World's largest offshore pipeline in the gulf has the green light from FPC. Agency has approved temporary sales certificate for C.A.T.C. group to sell more than 6 trillion cubic feet of gas to Tennessee Gas Transmission. It also issued temporary authority to T.G.T. to build 107-mile pipeline at cost of $16.3 million to connect its system to offshore reserve. Still unsettled is price of the gas. The producers and T.G.T. had negotiated a price of 22.4 cents per M.c.f.

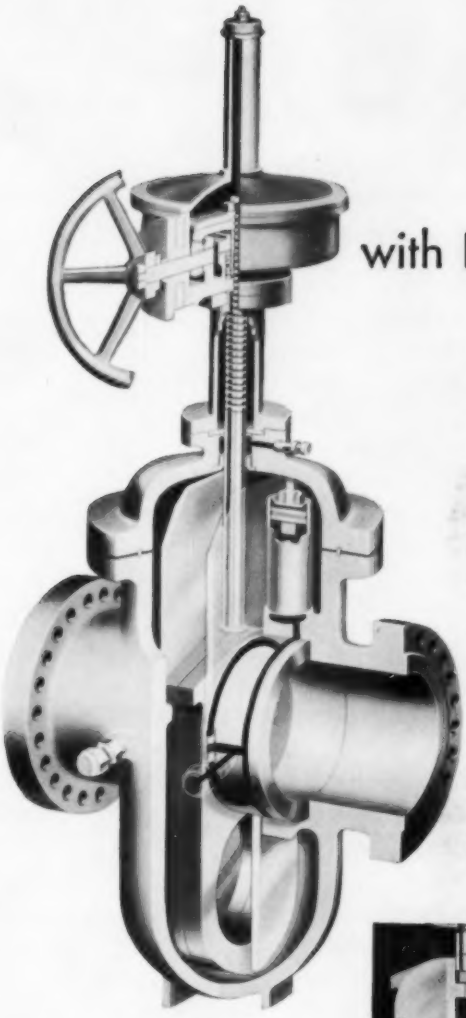
NATURAL GAS. The Harris-O'Hara gas bill starts on the long road through Congress next week. Harris has laid out 8 days of hearings and doesn't plan any lengthy wrangling. Observers now say if the measure gets to the House floor, it will be passed, and chances are good it will get to the White House before end of the session. The measure already has received Eisenhower's blessing.

Texas operators, as expected, are split in their views on Railroad Commission victory in the ratable-gas-take fight. Appeals court in Austin reaffirmed commission's right to order Permian Basin Pipeline to take gas ratably from all wells in Puckett Ellenburger field. Independents and some larger producers view decision as strong prop for correlative rights. Pipelines are dismayed that the Commission is allowed to break long-term contracts.

Arkansas Louisiana Gas is making plans to diversify its operations. Management is looking into fields related to petrochemicals, particularly plants using natural gasoline and L.P.G. as feed stocks.

NEW ADVANTAGES "GO ON THE LINE"

with DARLING-McEVOY Conduit Valves



Compare these features with *any* other pipe line gate valve:

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2. NON-DIRECTIONAL. Flow may be in either direction.

3. TWIN SEALANT RESERVOIRS. One for each port. Sealant feeds automatically to downstream side only.

4. NEGLIGIBLE SERVICING. Leak-proof closure requires very little sealant. Reservoir capacity ample for a great many operations.

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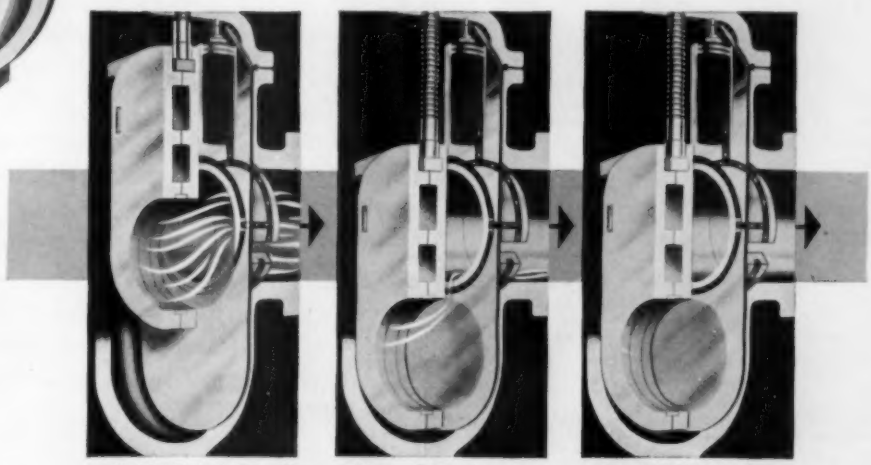
Above: *Cutaway showing heavy, self-aligning gate and parallel seat assembly, with one of the two sealing systems indicated.*

Right: *Diagrams of closure action on downstream side of gate.*



APPROACHING CLOSURE... *No loss of sealant as sealing groove in seat is disconnected from reservoir until gate is fully closed.*

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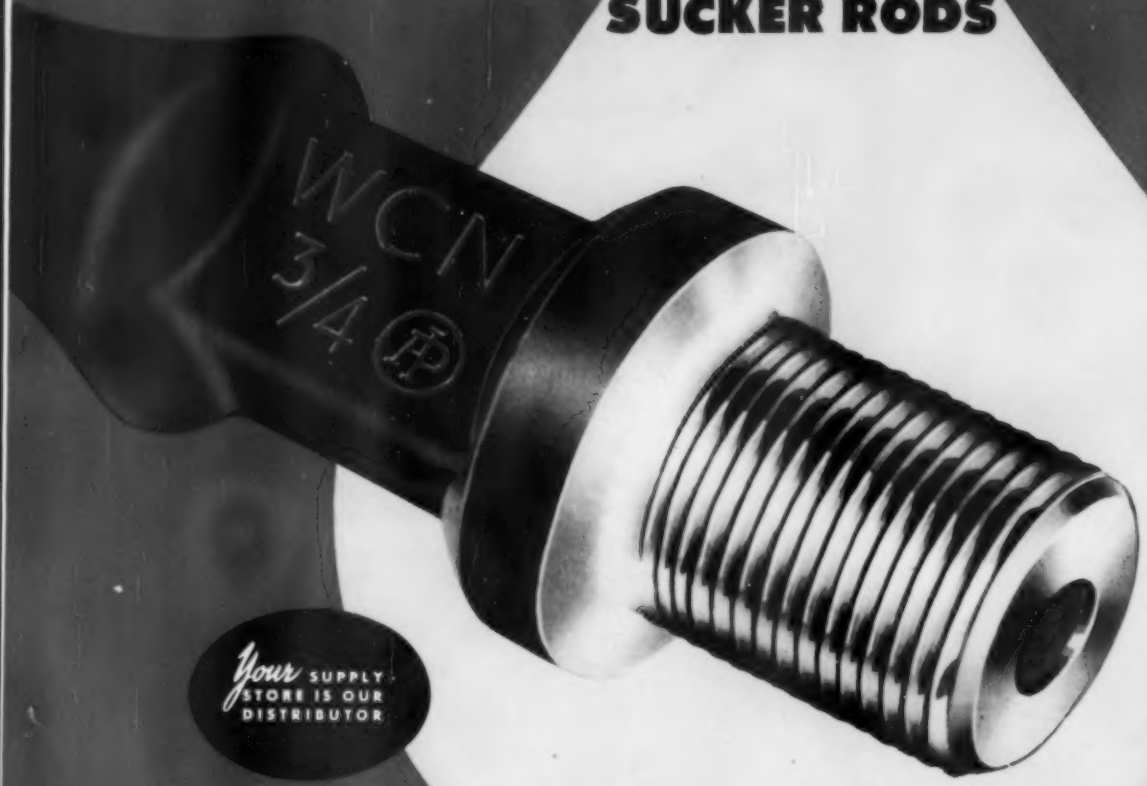

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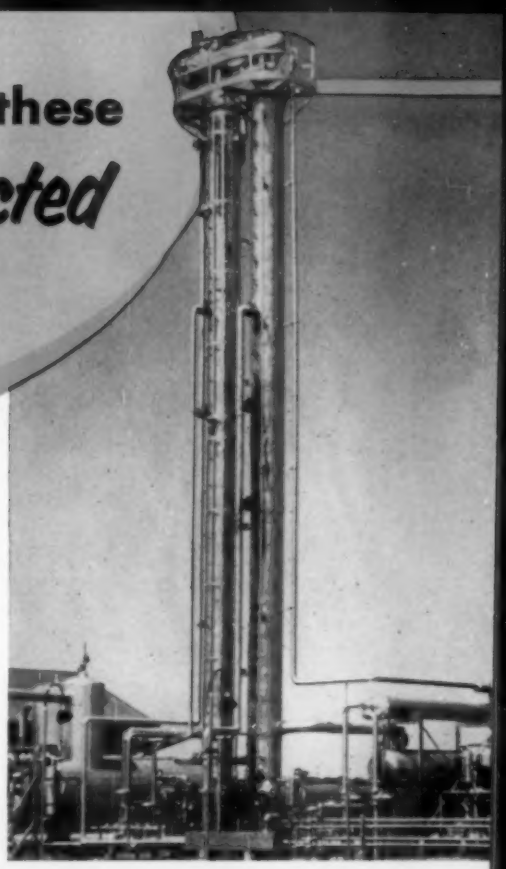

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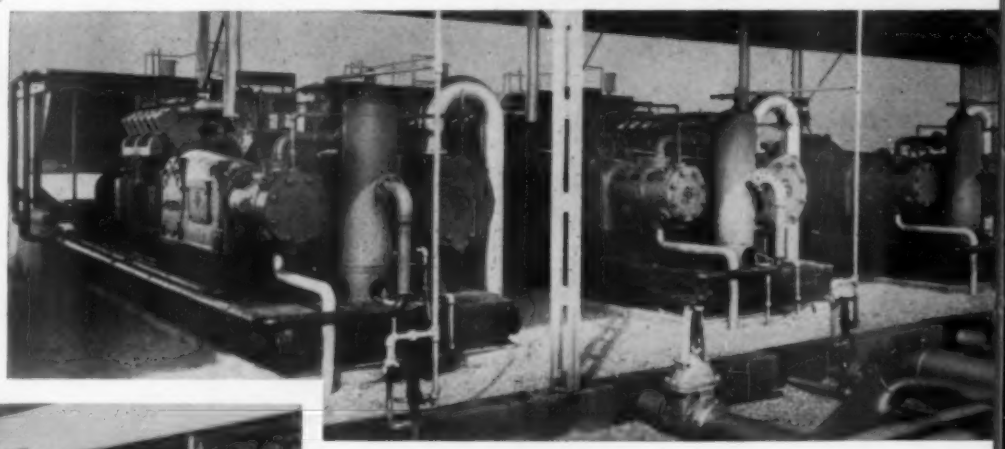
Units of this type are available in 125, 175, 200, 250 and 300-hp sizes. On all but the two larger sizes, up-draft radiators are mounted above the compressor gear box and supported directly from the skid base.

This bank of three direct-connected units are tied into a common header system, permitting flexibility of operation.



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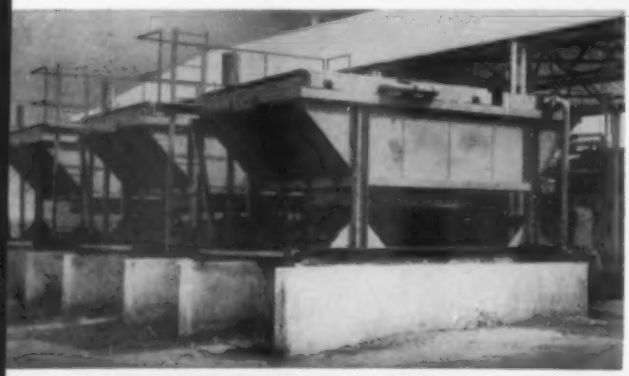

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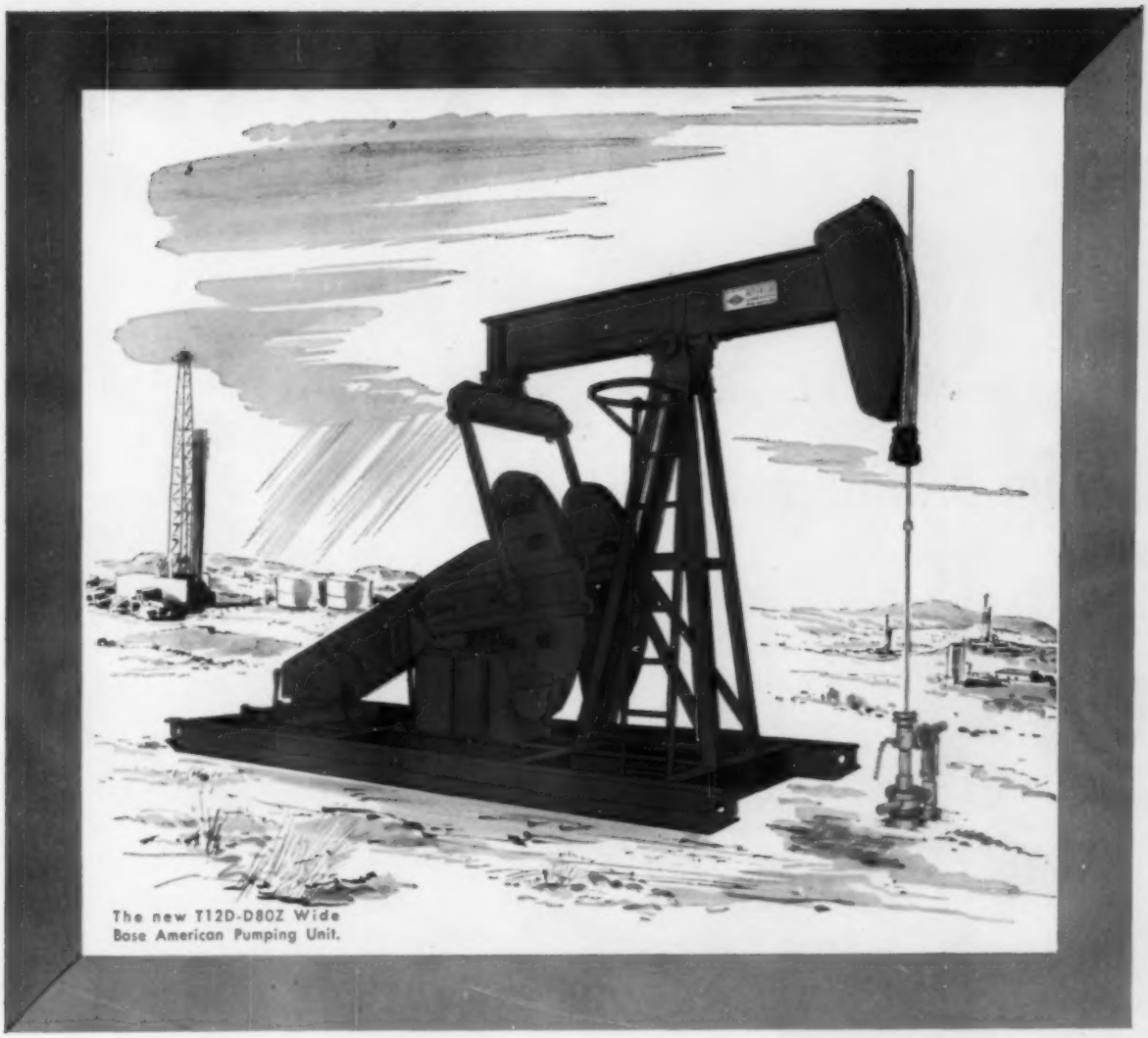

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Specify J&L drill pipe, casing and tubing for gas well drilling and production, J&L line pipe for gas transmission and distribution. When you buy J&L tubular products you buy long, dependable service on the job. Buttweld, lapweld, seamless and Electricweld are available in size ranges from ½" to 14" O.D.

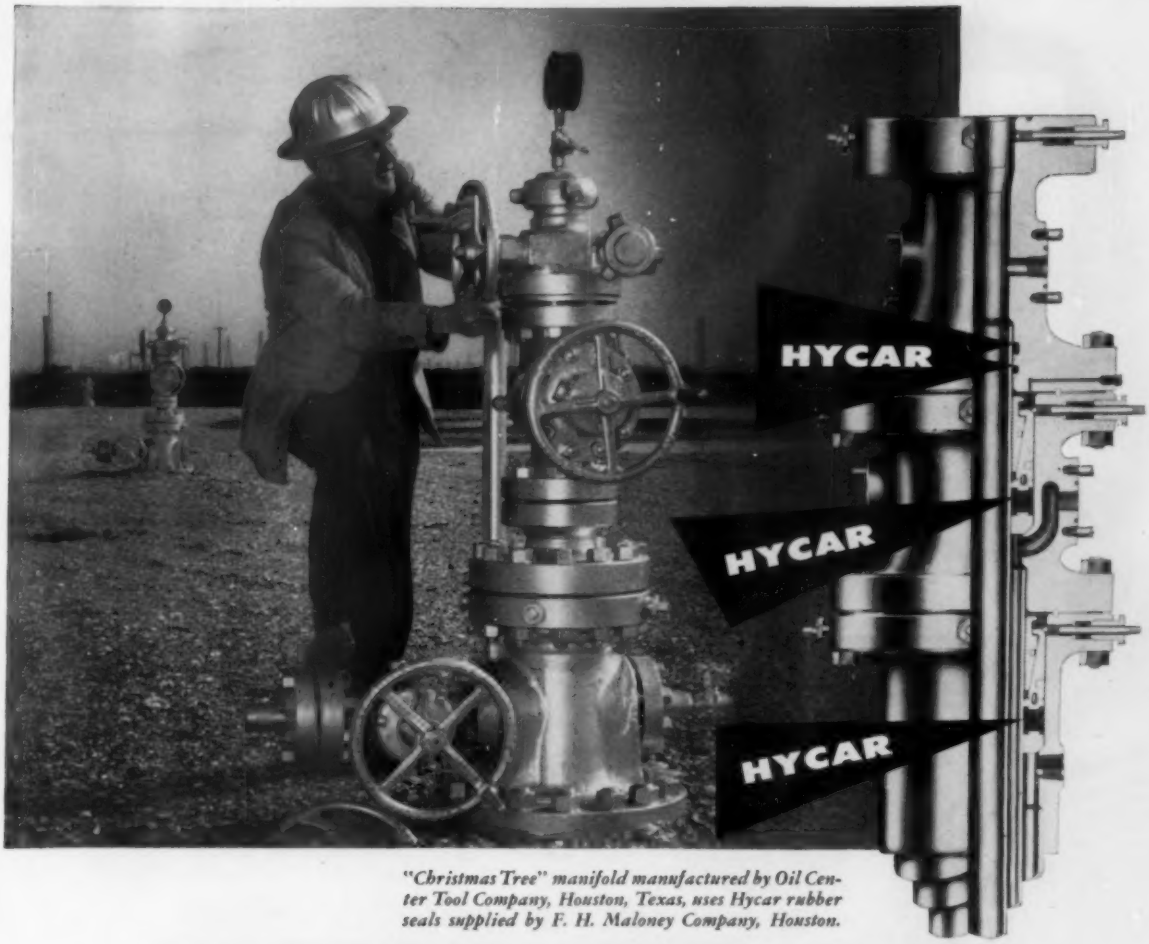
Write today for complete information on the J&L line of tubular products. Jones & Laughlin Steel Corporation, Department 416, Three Gateway Center, Pittsburgh 30, Pennsylvania.

Jones & Laughlin

STEEL . . . a great name in steel

Another new development using

B.F.Goodrich Chemical *raw materials*



"Christmas Tree" manifold manufactured by Oil Center Tool Company, Houston, Texas, uses Hycar rubber seals supplied by F. H. Maloney Company, Houston.

HYCAR SEALS LOCK UP HIGH PRESSURES

TO be sure their "Christmas Tree" manifolds have the utmost reliability, Oil Center Tool Company contains high pressures with well-head seals made from Hycar nitrile rubber.

Even when working under 5000 to 8000 psi in the deep fields of Texas and Louisiana Gulf Coast, these Hycar seals hold up. They are resistant to natural gas, distillate, and sweet and sour crude oil. This could avoid costly reworking operations—or even loss of the well itself.

Hycar nitrile rubber lives with hydrocarbons that destroy other types of rubber. It keeps its exceptional strength, resists shock and vibrations and stays flexible at high and low temperatures—is ideal for seals, liners, valve seats, cylinders, other drilling equipment parts.

For the whole Hycar story, write Dept. HB-3, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

Hycar Reg. U.S. Pat. Off.
American Rubber

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

B.F.Goodrich GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

...your low-cost key to high octane

Atlantic's Catalytic Reforming Process continues to prove its ability in giving superior results on a broad variety of feed stocks. Catforming's simplicity brings savings through increased efficiency every step of the way—actually eliminating many profit-robbing intermediate steps.

Regardless of the volume of your charge stock, Catforming deserves your attention. One major reason that Catforming has "proved out" commercially is attributable to Atlantic's broad experience in all phases of petroleum refining and processing.

We invite your inquiries on Catforming. Write or wire The Atlantic Refining Company, Research and Development Dept., P.O. Box 8138, Philadelphia 1, Pa.

ATLANTIC it's the CATALYST that counts

First with Floating Power

ALWAYS QUIET... ALWAYS QUICK

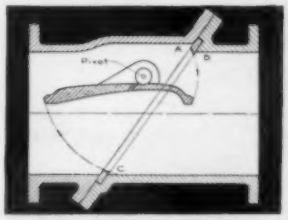
CHAPMAN

Tilting Disc Check Valve

You hear a lot about floating power these days. But Chapman Tilting Disc Check Valve has had it for quite some time. In fact Chapman was the first to have it . . . the first to have it in a valve . . . a feature that means much more to you in performance, much less to you in costs.

With Chapman's Tilting Disc Check Valve the "Airfoil" disc floats on the flow. When the flow is on, the disc balances perfectly . . . and quietly. There's never a flutter. No vibration. No trouble with head loss or flow resistance. And after the flow subsides the disc automatically drops to a closed position. The closing is fast. The closure is tight. No slamming. No banging. No damage to valve or system. No scraping or wearing of disc and seat. It all adds up to top performance and lowest maintenance and replacement costs even under severe operating conditions.

For handling fluids or gases under a wide range of pressures, always specify Chapman Tilting Disc Check Valves. They're available in iron or steel. Explained in full in our Catalog 30-A. Yours for the asking. Write.



Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

The CHAPMAN Valve Manufacturing Co.

INDIAN ORCHARD, MASS.

YOU GET A

BONUS

WITH EVERY

MIDWEST

"LONG TANGENT" ELBOW

21% to 42% MORE ELBOW AT NO EXTRA COST

It's a built-in bonus that comes right with the elbow . . . a tangent or straight section at each end of the fitting.* Benefits of this bonus . . . this extra value . . . are yours AT NO EXTRA COST because Midwest "Long Tangent" Elbows are PRICED THE SAME AS OTHER ELBOWS. It's a value you can't afford to miss.

For additional information, ask your Midwest distributor or write us for Catalog 54.

*Size 24" and smaller have tangents equal to ¼ nominal pipe size; for example, 12" ell has 3" straight ends. Above 24" pipe size, all tangents are 6" long.

ADVANTAGES OF MIDWEST "LONG TANGENT" ELBOWS

- They save pipe.
- They often eliminate short nipples and their extra welds.
- They save time and money in lining up and clamping pipe and fitting.
- They make it easier to apply slip-on flanges.
- They remove the circumferential weld from point of maximum stress and can be sleeved.

THEY COST NO MORE THAN OTHER ELBOWS

MIDWEST PIPING COMPANY, INC.

Main Office: 1450 South Second St., St. Louis 4, Mo.

Plants: St. Louis, Clifton, N. J. and Los Angeles

SALES OFFICES: ASHEVILLE (BOX 446, SKYLAND, N.C.) • BOSTON 27—426 FIRST ST. • CHICAGO 3—79 WEST MONROE ST. • CLEVELAND 14—616 ST. CLAIR AVE. • HOUSTON 2—1213 CAPITOL AVE. • LOS ANGELES 33—520 ANDERSON ST. • MIAMI 34—2103 LE JEUNE RD. • NEW YORK 7—50 CHURCH ST. • ONEIDA, N.Y.—282 NORTH MAIN ST. • SAN FRANCISCO 11—420 MARKET ST.

STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

7681

MIDWEST WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS

Results of fracturing using Adomite and lease crude

Well	Formation	Gallons Fracturing Fluid	Pounds Sand	Injection Rate BPM	Production, BOPD Before	After	30-60 Days After	6 Months After
A.	San Andres	10,000	10,000	5	2	28	35	—
B.	San Andres	15,000	21,000	5	4	54	120	65
C.	Springer Sand	6,000	12,000	3	8	40	51	51
D.	Penn. Cgl.	6,000	6,000	4	*	345**	144	80
E.	Miss. Chat	6,000	12,000	10	Dead	435	306	192
F.	Miss. Chat	6,000	10,000	5	10	—	33	30
G.	Miss. Chat	6,000	12,000	10	*	—	330**	360***
H.	Clear Fork	10,000	[illegible]	[illegible]	[illegible]	—	90	51
I.	Sussex "A"	[illegible]	[illegible]	[illegible]	[illegible]	53	45	52
						9	180	99
						9	67	51
						)	80	68
						[illegible]	49	30

More than 10,000 success stories fracturing with Adomite

Adomite® — and only Adomite does so many things so effectively!

Seals the fracture face . . minimizes fluid loss . . . no damage to formation.

Longer fractures . . deeper penetration of sands.

Fewer sandouts . . . reduces fluid loss in rock matrix, prevents buildup of sand concentrations in the fractures.

Saves you money . . . utilizes your own lease crudes . . . saves transportation costs.

Decreases friction loss . . . low viscosity of Adomite-created fracturing fluids permits use of less pumping equipment than with viscous refinery residuals.

Reduces hazard of emulsions . . emulsion-breaking characteristics are important consideration to many producers.

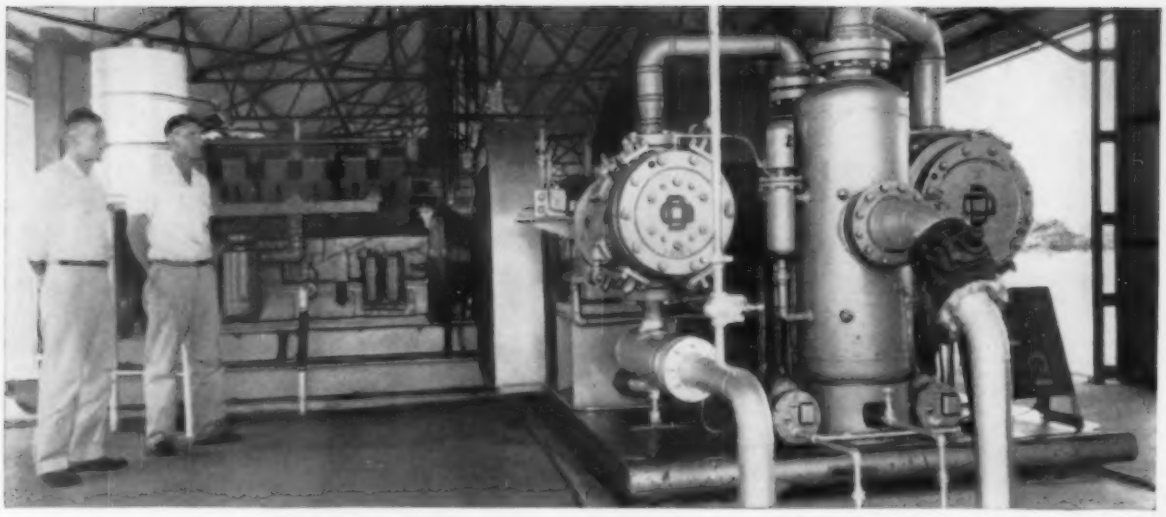
Adaptable to virtually all types of crude, Adomite is all you need to control fluid loss of kerosene, crudes, gelled crudes or refinery residuals.

Producers who say Adomite . . stay with Adomite.

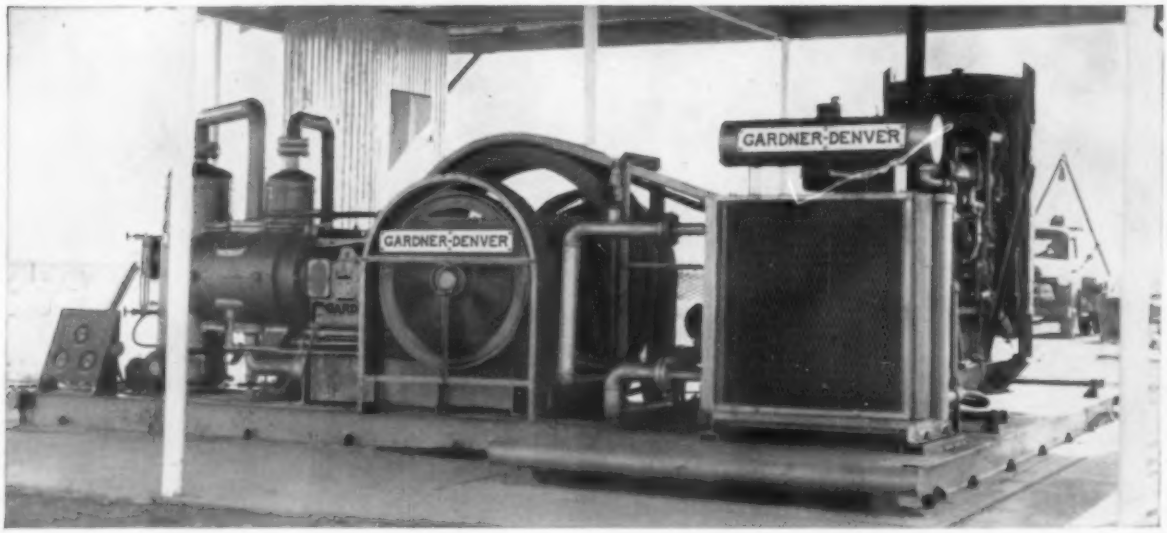
© 1957, Continental Oil Co.

Get greater profits from your next fracturing job

TELL YOUR SERVICE COMPANY TO USE Adomite



Complete gas compressor units "packaged" at our Dallas plant!



* Ready to truck in and hook up.
* Engineered to meet your field conditions.
* Backed by 60 years of engineering foresight in compressor design.

See your Gardner-Denver compressor specialist in Houston, Corpus Christi, Odessa, Wichita Falls, New Orleans, Shreveport, Oklahoma City, Ellinwood, Casper, Edmonton, Tulsa, Pittsburgh or Los Angeles.

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

GARDNER - DENVER

Gardner-Denver Company, Quincy Illinois—In Canada: Gardner-Denver Company (Canada) Ltd., 14 Curity Ave., Toronto 16, Ontario

Gardner-Denver Export Division, 233 Broadway, New York, N. Y.

Oil Field Offices: Dallas, Houston, Tulsa, St. Louis, Los Angeles, New York, Pittsburgh, Denver, New Orleans, San Francisco, Kansas City, Winnipeg, Edmonton.

Consistency is TRADITIONAL at WESTERN

Consistency is vital to HF ALKYLATION

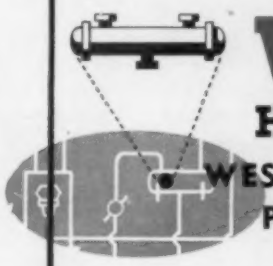
In this commercial use of hydrofluoric acid as a catalyst for the alkylation of olefins with isobutane, *consistent high quality of product* is of paramount importance in this well-established process.

HF Alkylation for the production of high octane motor fuel blending components demands *equal consistency* in the performance of the heat transfer equipment used to cool the reacting streams.

Western Heat Exchangers are characterized by consistency throughout their design and manufacture—from initial rating to completed fabrication.

Whatever the heat transfer requirement of your process, a proposal from Western should be your first consideration.

Water cooling of reacting streams is being efficiently handled by Western exchangers in many HF Alkylation units currently in operation.
There is a Western representative ready to serve you—**today.**



WESTERN
HEAT EXCHANGERS

WESTERN SUPPLY COMPANY
P. O. Box 1888 – Tulsa, Oklahoma

This man helps move 175 carloads of caustic at a time

(He's a deck officer on the Marine Dow-Chem)

After a few terse commands from the bridge, the 18,000-ton *Marine Dow-Chem* glides silently into the night. With her cargo of vital chemicals the *Dow-Chem* plies her way to key Dow terminals. In her storage tanks there is enough caustic soda to fill 175 tank cars.

Typical of the foresighted Dow attitude of solving a problem before it arises, the *Dow-Chem* was commissioned in 1954 with an eye to the future needs of industry. Today, this specially equipped ship is an important part of our vast distribution system.

As demand increases, Dow will continue to lead the way in developing new methods to deliver caustic soda to your doorstep in any form or quantity. THE DOW CHEMICAL COMPANY, Midland, Mich., Dept. AL. 600D-1

YOU CAN DEPEND ON DOW

TRECO—CONTRACTOR TO AMERICA'S FAMOUS REFINERS*

The REFINERY ENGINEERING Company is proud to have served the majority of America's best-known refiners in the field of Engineering, Design and Construction. Each year sees our list of satisfied clients expanding.

Back of this steady expansion is the satisfactory completion of each contract on, or ahead of time; the ease and economy of operation of the plant as well as the small amount of "down time."

Treco has purchased a tract of land, in excess of three acres. This new facility provides more than 14,000 square feet of air-conditioned offices with paved parking for over 200 cars. There is also a cafeteria building and two other buildings of 9,700 feet and 37,000 feet of space for expanding Treco activities.

* The Trade Marks above are of the companies Treco has recently served.

The REFINERY ENGINEERING Company has just produced a brochure which shows the Company's facilities with photographs of completed projects. A copy will be mailed you promptly upon request on your company's letterhead.

ESSO STANDARD OIL COMPANY

McCOLL-FRONTENAC OIL COMPANY, LTD.

PHILLIPS PETROLEUM COMPANY

CONTINENTAL OIL COMPANY

SHELL OIL COMPANY

THE TEXAS COMPANY

SINCLAIR REFINING COMPANY

COSDEN PETROLEUM CORPORATION

D-X SUNRAY OIL COMPANY

ROYALITE OIL COMPANY, LTD.

KERR-McGEE OIL INDUSTRIES, INC.

DIVISION of VITRO CORPORATION of AMERICA

The REFINERY ENGINEERING Company

NEW YORK TULSA TORONTO

"All UNIONS aren't the same -- specify WECO by name"

Examine a WECO Union and you will see that all unions are not the same.

The difference is readily noted in WECO'S metal-to-metal ball and cone seat that is unequaled for positive, leak-proof sealing under the severest conditions.

The ease and speed of repeated make-up and break-out is apparent in the sturdy, accurately cut Acme threads.

The extra strength of WECO Unions is evident in the heavier wall sections that are machined and knurled for uniform wall thickness and safer wrenching . . . in the sturdy wing nut that takes heavy hammering as a matter of course.

These differences in design and construction make WECO Unions superior in sealing and economical in service. That's why it pays to specify WECO Unions by name, from supply stores everywhere.

U-13-56

WECO®

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of*
FOOD MACHINERY AND CHEMICAL CORPORATION

PESA

fmc

Here's the Answer...

To trouble-free pressure vessel mixing

Philadelphia "packaged" Mixers are designed for maximum adaptability to all fluid agitation applications. Standardization, high-production and complete control of all manufacturing by Phillie Gear assures you outstanding mixer performance at minimum cost.

Check these unmatched features:

1 Mechanical seal readily accessible . . . just loosen coupling bolts . . . entire shaft and impeller assembly is then independently supported . . . *no lifting equipment required* for replacement of seals.

2 Lower shaft bearing placed close to seal for minimum runout . . . separated sufficiently to prevent interleakage of lubricants.

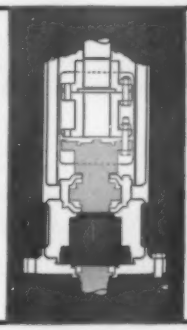
3 In-tank coupling optional . . . provided if desired for easier unit installation . . . not necessary where process conditions limit its use.

4 Seal will operate for years without maintenance . . . is designed for quick replacement as a single unit . . . retention of factory-established shaft alignment is assured.

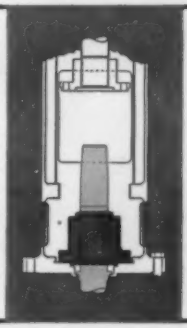
For complete information, please request Bulletin A-256.

One man and a wrench can remove and replace this new Unitary shaft seal in minutes.

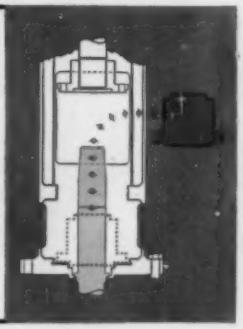
(1) Loosen lock ring at top of seal. MIXER SHAFT IS NOW FREE TO MOVE UP OR DOWN THROUGH SEAL. Next, loosen extra long bolts in lower flange of spacer coupling. Shaft drops until collar rests in cup on mixer base flange. The entire weight of lower shaft and impellers is supported by this assembly.



(2) Remove bolts and pull out spacer, thrust plate and half coupling from top of mixer shaft. Unbolt and remove top of lower bearing housing. Loosen bearing lock nut, remove bearing components and lower half of housing. Note that absolutely no lifting equipment is needed.



Remove mechanical seal assembly by simply sliding it up mixer shaft and out through opening in reducer support stand. Replace with a spare seal assembly and ship the old seal to us for maintenance.



philadelphia mixers

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.

Offices in all Principal Cities

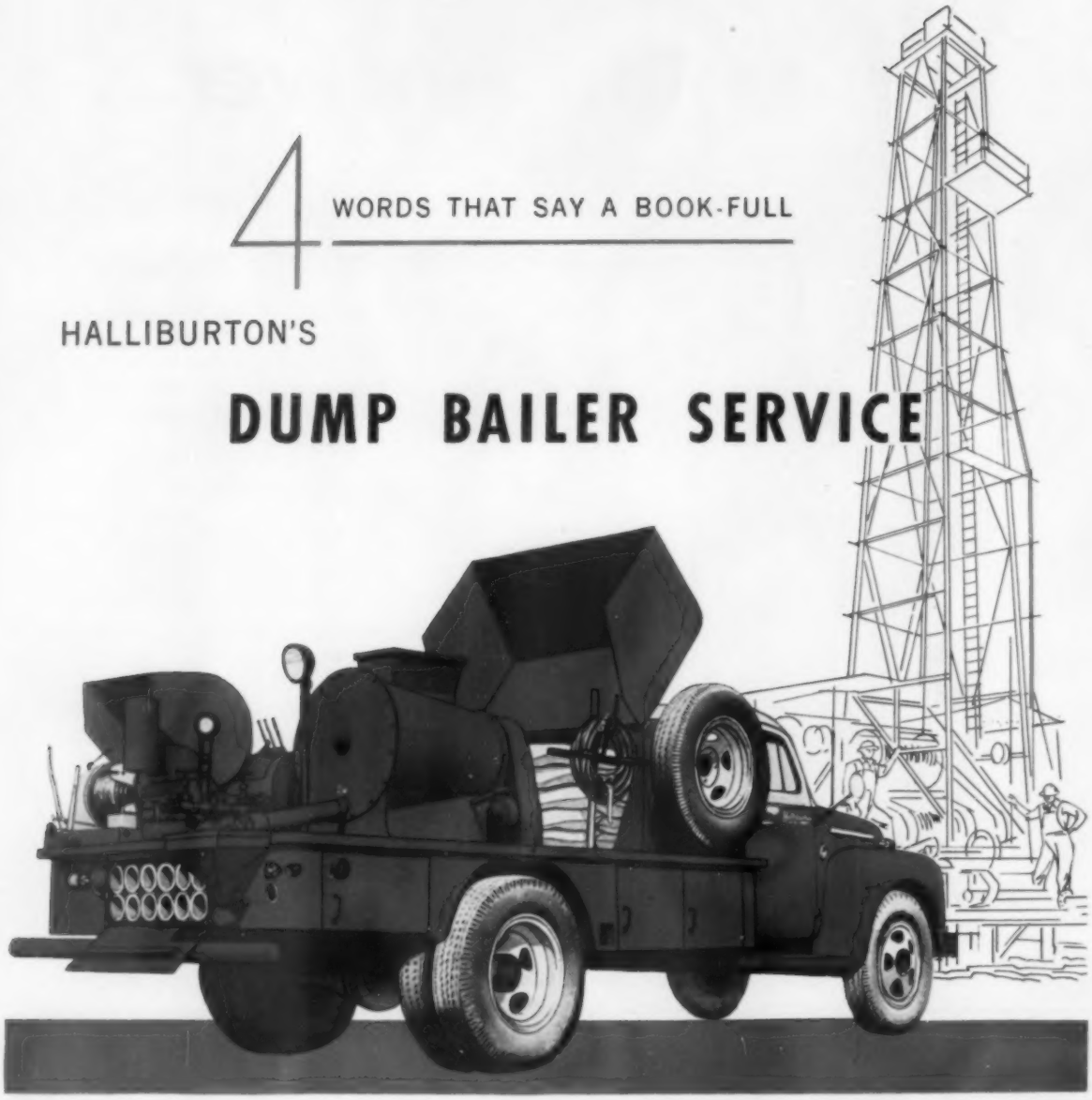
INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

Virginia Gear & Machine Corp. • Lynchburg, Va.

4 WORDS THAT SAY A BOOK-FULL

HALLIBURTON'S

DUMP BAILER SERVICE



Here's a complete, smoothly integrated service, developed through 16 years of experience in remedial operations, that can save you valuable time and cut the cost of shot tamps, plug-backs, bridge plugs for pipe repairs, securaloy removal and other odd-jobs encountered in remedial work.

When you specify Halliburton's Dump Bailer Service, these four words bring you the valuable benefits of Halliburton's developments in equipment and techniques. Placing gravel has been simplified. New equipment, using a special stuffing box and quick-change head, permits the operator to apply pressure for squeezing materials into formation or for other purposes while the bailers remain in the hole. Small Knife-Type Bailer bottoms make it possible to perform Dump Bailer techniques inside tubing.

HALLIBURTON DB BRIDGING BASKET

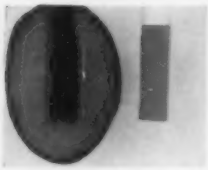
Makes remedial work off bottom of open hole or inside casing more economical. Attached to Bailer section by special adapter, it is lowered to any depth in open hole or casing with quick-setting materials in the Bailer, ready to be dumped. A slight pickup of the Bailer sets and opens the Bridging Basket and dumps the material simultaneously.

CAL-SEAL

A super-strength gypsum cement, manufactured and mixed with chemicals to insure a stabilized controlled set. Setting time can be accelerated or retarded to meet special conditions. Expansion upon setting produces a tight plug. Low permeability effectively keeps out unwanted gas or well fluids.

HYDROMITE

A proven waterproof plastic base gypsum cement. Unlike a regular cement slurry, the fluid phase of Hydromite contains a resin that sets up when squeezed out into the formation. Penetration is brought about by applying a differential pressure of 50 to 60 psi on the material when it is in contact with a porous permeable formation. This feature, plus expansion at time of initial set, makes Hydromite a superior, non-permeable plug for plugging off bottom hole water in producing wells.



RESIN-CEMENT

A blend of resins, water and portland cement, designed for open bottom hole plugs, setting around casing shoe or opposite water zones and other remedial work in oil or gas wells where ordinary cementing materials fail. Dump Bailers are used to place Resin-Cement in small volume or when it is not practical to pump through tubing. The set Resin-Cement is not attacked by oil, gas or formation water and will resist the action of common acids.

Don't put off the remedial work needed to make your well a better . . . more profitable producer. Halliburton Dump Bailer Service is fast, versatile, effective and economical. Call the local or district office or write the Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

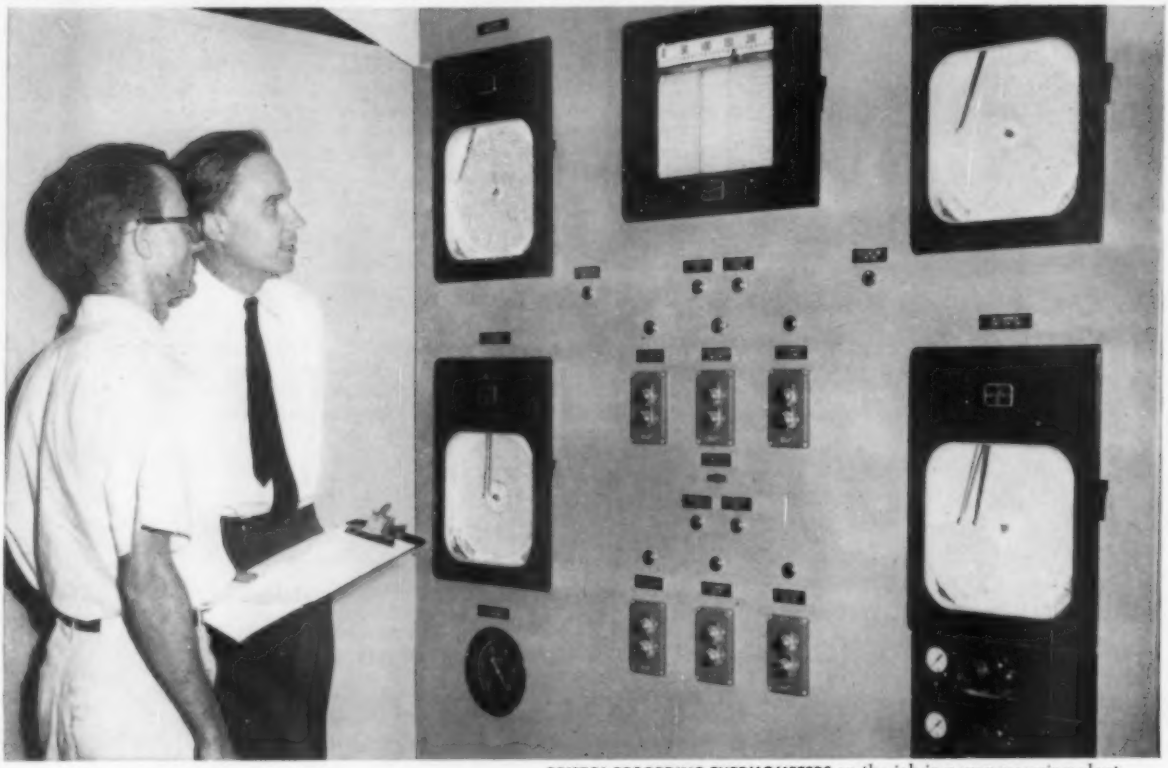
ASK FOR THE "DUMP BAILER SERVICES" BULLETIN

HALLIBURTON OIL WELL CEMENTING COMPANY

CEMENTING SERVICES

251 SERVICE CENTERS — JUST MINUTES AWAY FROM ANY RIG

WHAT'S NEWS AT BRISTOL...



BRISTOL RECORDING THERMOMETERS on the job in new processing plant.

Can you pass this recording thermometer quiz?

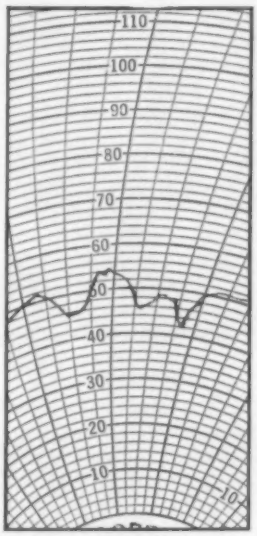
***Question:** Why do Bristol Recording Thermometers continue to lead the field?*

***Answer:** Because of Bristol's continuous research and development program. Two outstanding results of this program are:*

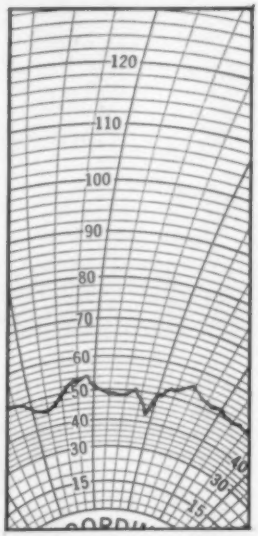
1. The 2L Uniform-Scale Vapor Pressure Thermometer which gives you all the advantages of vapor pressure thermometer actuation without the problems of the conventional non-linear increasing scale—*greatest advance in recording thermometers in 25 years.*

2. A basic improvement that eliminates ambient temperature effects. Whether you are measuring *above, below* or *at* ambient temperature, you get the same unvarying accuracy with the new Bristol Vapor-Pressure Recording Thermometers.

Want to know more? Write today for free 48-page bulletin T840 on the complete line of Bristol Recording Thermometers, liquid, vapor-pressure, and gas filled for every application. It tells all about typical installations, ranges, charts, bulbs, tubing. The Bristol Company, 120 Bristol Road, Waterbury 20, Conn.



NEW LINEAR CHART for 2L. Note easy readability due to equal chart increments.



OLD NON-LINEAR CHART. Note how scale values crowd together at bottom.

6.82

BRISTOL

TRAIL-BLAZERS IN PROCESS AUTOMATION

BRISTOL'S

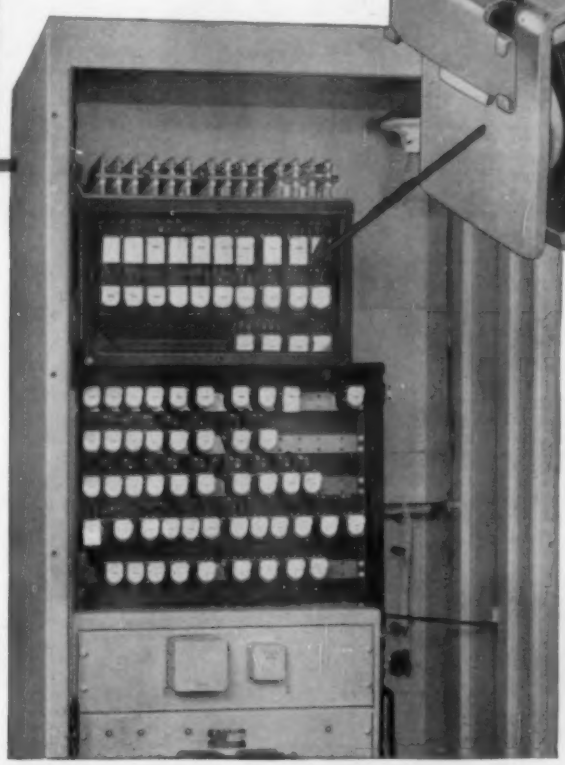
AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

UNION C.T.C. —the pipeline control system with BUILT-IN RELIABILITY

4,000,000 operations a year.

This is regular performance for this L-Type UNION Relay used in the coding unit which transmits and receives all codes. Relays have bifurcated contacts, self-wiping action and chromium plating at the wear points to assure maximum reliability. Coil and contact assemblies are designed to withstand 3000-volt breakdown test.

UNION L-Type Relay



UNION Centralized Transport Control Equipment for the central office (back view) uses plug-connected units for ease of handling.

RELAYS are the key to reliability in Centralized Transport Control Systems—and UNION has been building top-quality relays for more than 75 years.

Here's the proof of outstanding performance: 443 UNION relay coding units, the kind used in railroad and pipeline C.T.C. Systems, were brought into the shop for cleaning and repairs. These had been in service without maintenance from one to 10 years. *For 65% of the units, no repairs were required*—only cleaning and adjustment. 10% required slight repairs on the relay contacts. The remaining 25% had been damaged by lightning. The relays in these units averaged about four million operations a year.

This is an example of the reliability that is built into the components used in a UNION C.T.C. System. It means that you can expect a UNION System to go to work and keep on working with the least possible maintenance cost. Write for a copy of our Bulletin 1052.

Quality First...TO LAST

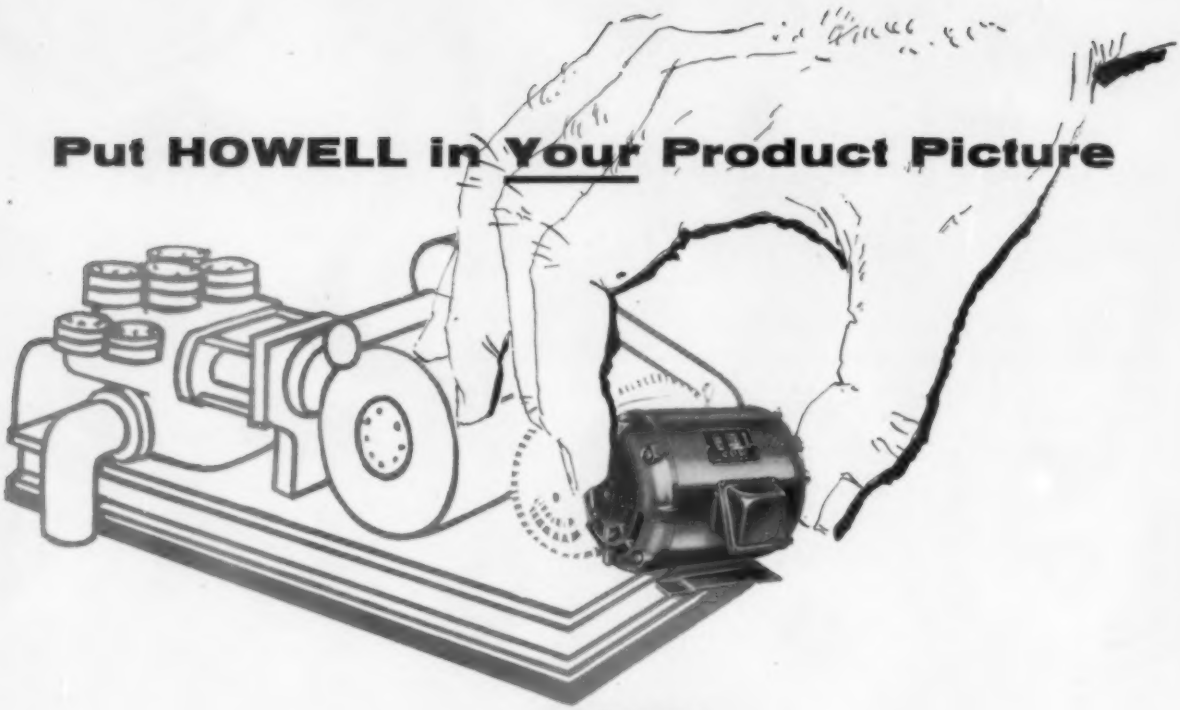
GENERAL APPARATUS SALES

UNION SWITCH & SIGNAL

DIVISION OF WESTINGHOUSE AIR BRAKE COMPANY

PITTSBURGH 18, PENNSYLVANIA

Put HOWELL in Your Product Picture



...and gain the PLUS values in power that count!

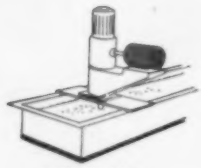
Manufacturers and users of oil pumping equipment demand extra dependability in motors that must keep their pumps operating 'round the clock. That's why Howell motors are specified in this and many other oil industry applications. Ideal for this type of use are Howell's heavy-duty weather-protected motors built in sizes up to 300 hp. They're rodent-proof, rust-proofed inside and out.

Steel Feet and Frames Won't Crack Under Stress Unlike cast iron, Howell's steel feet won't crack when mounting bolts are tightened excessively. Howell's cold-rolled steel frames can take installation punishment. Cast iron end-plates assure constant shaft and bearing alignment.

Cool-Running, Long-Lasting Efficiency New stator design with wide slots provides 50% more contact between cooling air and stator laminations. Combined with heat-dissipating copper rotors, this gives you a motor with extra stamina to withstand intermittent overloading or unusually high operating temperatures.

Functional Streamlining Howell motors have no fins, ribs or unnecessary offsets to collect dust deposits. External dirt cannot reduce these motors' cool-running efficiency — their neat appearance is easier to maintain.

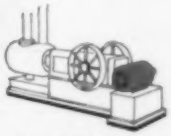
Wide Selection Howell makes virtually every type of AC industrial motor . . . in sizes from ¼ thru 300 hp, in all standard enclosures, in rerated and non-rerated frame sizes, and in many pump mountings. For significant savings in first cost on applications requiring reduced voltage starting (compressors, pumps, etc.) investigate Howell part winding motors.



MUD MIXERS

OIL WELL PUMPS

PROCESSING PUMPS



COMPRESSORS

MOTORIZED VALVES

Howell motors are used by these leading manufacturers of equipment for the oil industry:

Philadelphia Gear Works, Inc. ● The Worthington Corp. ● Dennison Engineering Co. ● Aurora Pump Division, The New York Air Brake Co. ● Blackmer Pump Co.

A Howell sales engineer can give you valuable assistance on any motor application. Wire or 'phone collect . . . or drop us a line . . . you'll get prompt action. Howell Electric Motors Co., Howell, Michigan.

HOWELL *motors*

. . . precision built for industry since 1915

KONTOL

...a proved gasoline plant corrosion preventive

In the gasoline plant, as well as in the refinery, Kontol corrosion inhibitors are preventing thousands of dollars worth of corrosion destruction. Kontol is not an experimental corrosion inhibitor, but has been used successfully in gasoline plants all over the country. In absorption systems less make-up oil is required since Kontol completely rids the system of corrosive products which discolor and contaminate the absorption oil. In addition to its corrosion inhibiting properties, Kontol's anti-fouling and its detergent characteristics serve to keep condensers and heat exchangers free from fouling. In many cases, the savings in cleaning costs even exceed the savings derived from corrosion prevention.

IN THE GASOLINE PLANT
KONTOL
PREVENTS CORROSION IN

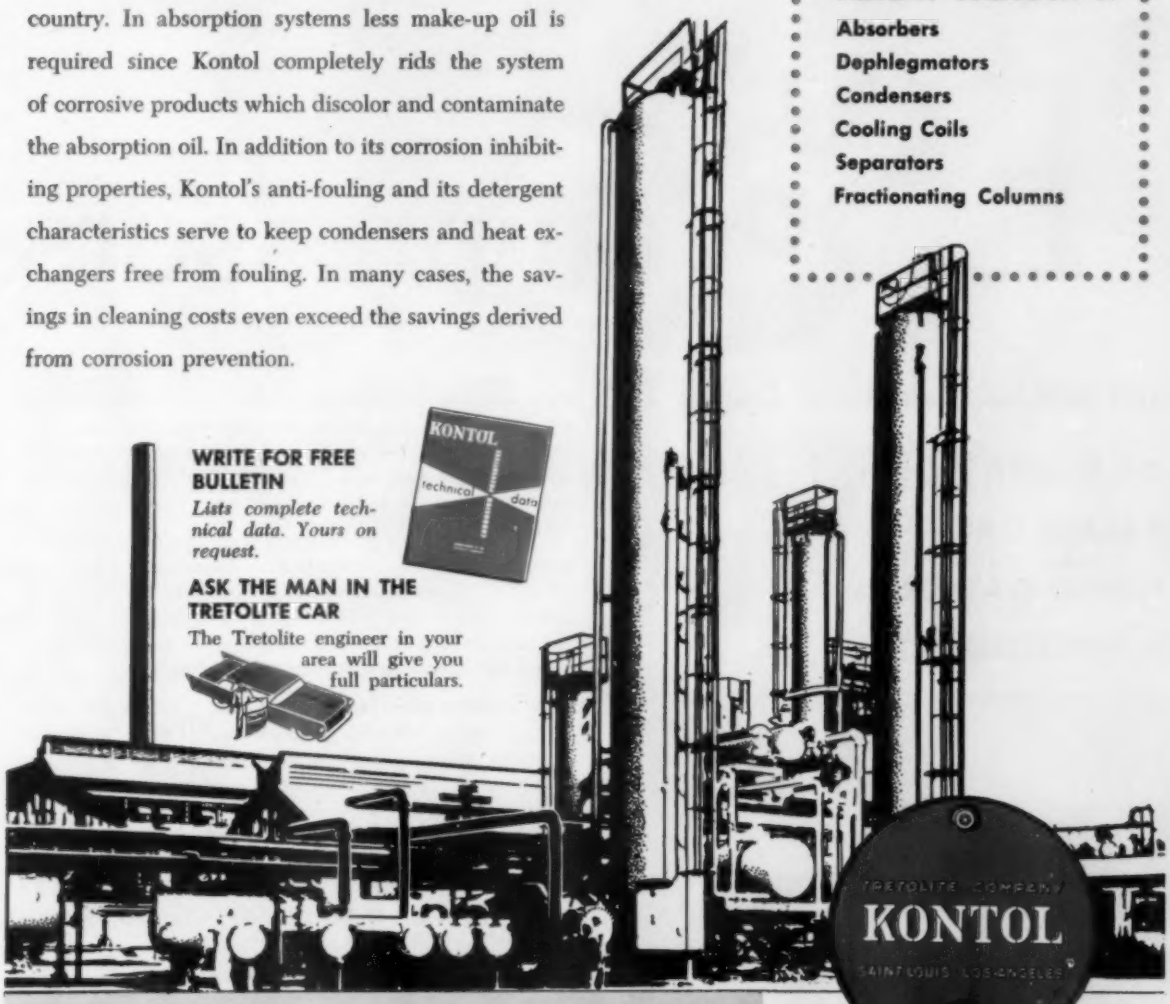
- **Absorbers**
- **Dephlegmators**
- **Condensers**
- **Cooling Coils**
- **Separators**
- **Fractionating Columns**

WRITE FOR FREE BULLETIN

Lists complete technical data. Yours on request.

ASK THE MAN IN THE TRETOLITE CAR

The Tretolite engineer in your area will give you full particulars.



TRETOLITE COMPANY

A DIVISION OF PETROLITE CORPORATION

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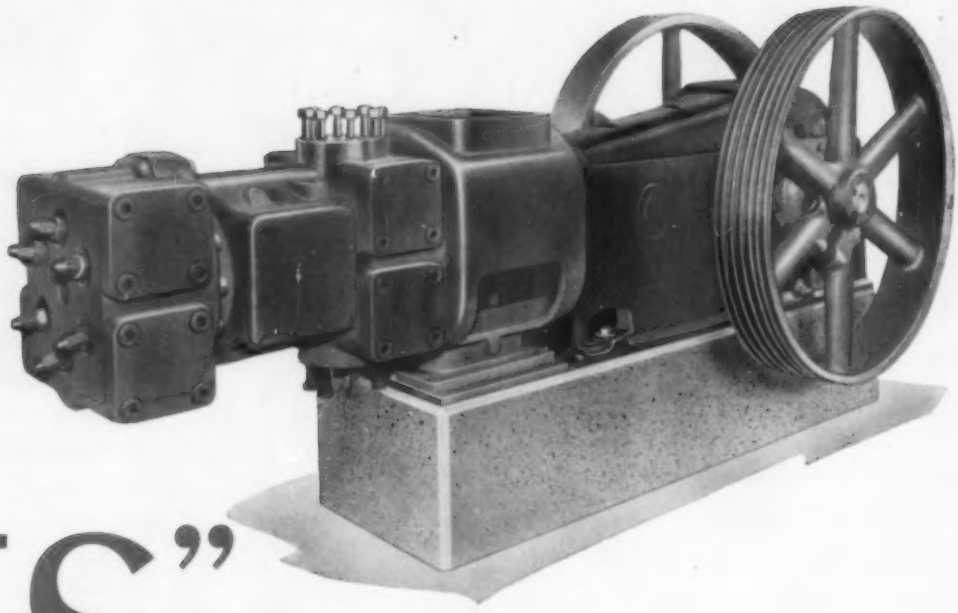


"ES" compressors

are the workhorses for . . .

- GAS LIFT
- FLARE GAS
- FIELD GATHERING
- REPRESSURING

Ingersoll-Rand ES compressors are widely used in oil field service. Above is one of hundreds of packaged plants built by Wilson Supply Co.

They work, work, and keep on working day after day, and year after year. Ingersoll-Rand built them that way. The ES was specially designed for continuous heavy-duty service, and the reputation of thousands of units in service prove it. They last for years, even when roughing it in the oil fields.

Attendant free . . . trouble-free . . . Hundreds of ES compressors are on services in the oil fields where an attendant comes around only once a day, or perhaps only a couple times a week. And when general inspection or overhaul is advisable, the Ingersoll-Rand "ES" is so easy to get at.

Most versatile compressor you can find . . . Above is an ES with a booster cylinder for pressures up to 1500 psi . . . specially made to meet oil field demands for versatility. Of the liner type, its construction permits a wide range of cylinder diameters without loss in performance and efficiency. You can change liners and pistons in any machine shop to meet new pressure conditions . . . another reason you can get the most for your specific conditions. The ES can be belt-driven as a single unit or two of them can be combined for two-stage compression.

When you need another compressor, be sure it's an Ingersoll-Rand ES.

Four stroke sizes . . 20 to 150 horsepower

Ingersoll-Rand

1-415 11 Broadway, New York 4, N. Y.

Mack cabs are a lesson in compact, functional design. The extra space you pick up with a Mack B Model cab goes right into increased payloads.

Mack trucks earn more... get more done... because PART FOR PART, MACK TRUCKS ARE THE BEST BUILT

Take the Mack B Model Cab!

It's a compact, handsome unit that's packed with advanced features for safety, economy, driving ease and million-mile durability.

- Drivers like the roomy comfort, the draft-free ventilation, the smoothly operating controls and unsurpassed visibility.
- Mechanics like the engine accessibility and the wide, wide working area when the hood is up . . . the quickly removable door panels, instrument panels and fenders . . . and the easily accessible fuse board in the glove compartment.
- You will like the rugged strength that underlines their safety . . . the greater payloads . . . the stamina that rolls back upkeep costs and the handsome lines that add prestige to any fleet.

And the same uncompromising superiority is built into *every* Mack component: engines, transmissions, axles, frames and rear ends. Part for part, no other truck is built like a Mack, stands up like a Mack, or has the low-upkeep, high-performance, *higher* earning power of a Mack. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd.

UNITIZED construction—an important Mack exclusive

Mack B Model cabs need less attention, ride more quietly, keep their rugged good looks longer than any other make . . . thanks in large part to Mack's unitized cab-and-front-end construction.

Cab, fenders, running boards, hood, and radiator shell are mounted *as a single unit* that rides on four rubber cushions in a diamond pattern.

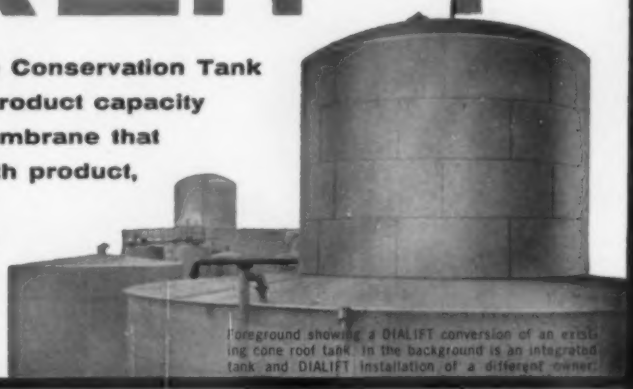
Results? All components remain in line, unaffected by frame flexing. Components never "fight" one another. Rattling, buzzing and squeaking are eliminated. And the whole cab can be removed as a single unit, in one fast hoisting operation, to expose the engine and chassis for faster powerplant removal or sheet metal repair.

4696

MACK
first name for
TRUCKS

The HAMMOND
DIALIFT

The ONLY membrane type Conservation Tank with full-rated vapor and product capacity AT ALL TIMES, with a membrane that cannot come in contact with product, vapor space that can be isolated for inspection and maintenance without taking product storage tank out of service.



Foreground showing a DIALIFT conversion of an existing cone roof tank. In the background is an integrated tank and DIALIFT installation of a different owner.

Principle of the Hammond Dialift

A— DIALIFT DIAPHRAGM rises and falls to accommodate expanding and contracting vapor.
B— Vapor passes to and from tank and DIALIFT through simple elbow connection.
C— DIALIFT and tank have full-rated capacity.
D— Membrane can't come in contact with product.
E— DIALIFT can be isolated for maintenance and inspection, product tank stays in service.

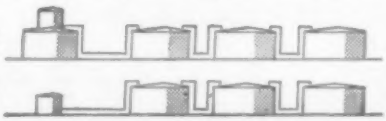
The most efficient and economical vapor conservation system for new or old tanks.

THE HAMMOND DIALIFT consists of a gas-tight Vulcalock membrane attached to the inside periphery of a cylindrical metal housing to become a "breathing" apparatus to accommodate the expanding and contracting vapor as developed in product storage tanks. The DIALIFT can be used as a single conservation unit by being attached to the roof of a product storage tank or as a central "breathing" system by being manifolded to a number of product storage tanks. There are two forms of installation: —Ground type manifolded to a number of tanks to form a conservation system and integrated type whereby the DIALIFT is attached to the roof of a product tank for vapor conservation for one or a number of tanks.

The DIALIFT is completely isolated from the product storage tank. Vapor passes between the tank and DIALIFT through a vaporline connection. It is easy to convert old cone roof tanks to efficient vapor-saving DIALIFT installations by attaching a DIALIFT housing with membrane to the roof of the old tank and connecting the vaporline between the tank and DIALIFT.

New or converted DIALIFT tank, inter-connected with cone-roof tanks, becomes central "breathing" unit.

DIALIFT GROUND UNIT serves as central "breathing" apparatus of multi-tank conservation system.



THE HAMMOND DIALIFT ELIMINATES BREATHING LOSS AND REDUCES FILLING LOSS

Other HAMMOND Bulletins describe these individual types of tanks: Floating Roof, Diaflote*, Vaporlift, Field Erected Underground, Elevated Water Tanks and Standpipes, Low Pressure, Bulk Storage.

WRITE FOR DIALIFT CATALOG 55DL

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New 111-TA Cementing Unit—best in the field!

MEN *make service!*

BUSTER BRAZEEL

...a man with the POWER!

Take an able, experienced cementer... give him powerful pumping equipment and service facilities to back him up... and you've got an unbeatable combination!

John H. (Buster) Brazeel is a man who packs this kind of power at your well site. Twenty-six years experience and more than 4500 jobs have sharpened his skills. The newest, most powerful equipment in the field is at his command.

Buster operated one of the first power cementing trucks ever seen in the oil patch. Today, when he supervises the operation of one of our latest 111-TA Cementing Units, he's using that equipment in the way to get the job done fastest and *best!*

You benefit every time you rely on this BJ Service-Chemical Process combination—experienced men and the most advanced equipment.

On your next job, why not call on the men who make service—and who know how to use the equipment to make service *best.*

CHEMICAL PROCESS
BJ
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SUBSIDIARY OF BORG-WARNER CORP.

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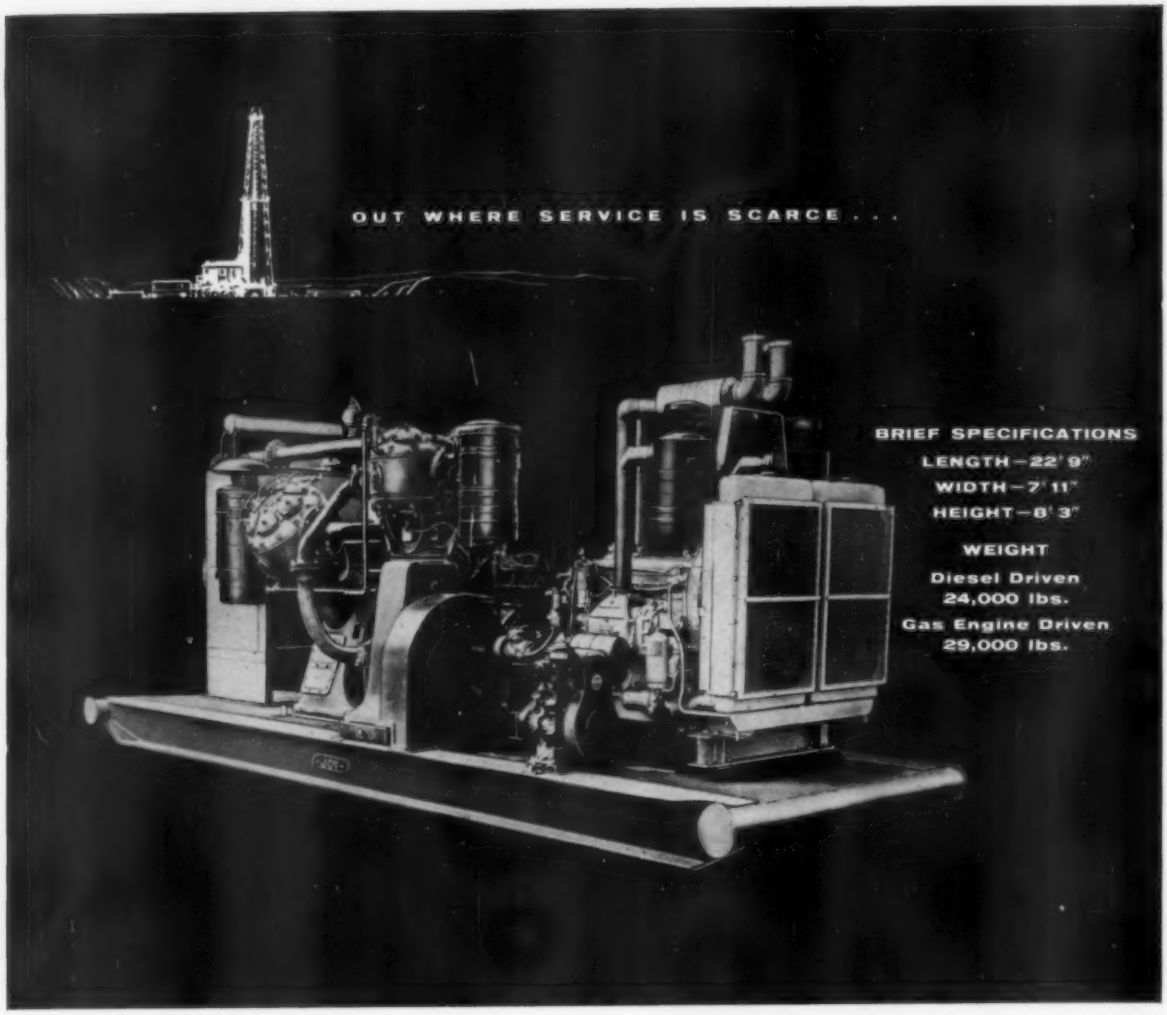

THE JOY AP-2 "PACKAGE" COMPRESSOR . . . *designed* FOR AIR DRILLING

DRILLING CONTRACTORS: We found out what you had to have in a compressor to drill with air successfully . . . then we *built* it.

The AP-2 gives you plenty of air . . . 1056 cfm at 125 psi or 647 cfm at 250 psi. The AP-2 is rugged . . . takes all the abuse of day after day operation out in the open. And it has all the features you've asked for: REMOTE CONTROL OPERATION: regulated by lever controls at the drillers console. INSTANT PORTABILITY: mounted on a single, oil-field type skid—ready for over-the-road hauling. TRUE PACKAGE UNIT: Completely self-contained . . . always ready to run.

For real success with air drilling use a compressor *designed* for air drilling . . . the Joy AP-2. ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

WSW O-6594-171

JOY... EQUIPMENT FOR THE OIL FIELDS . . . FOR ALL INDUSTRY

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Portable Hoists

Shot Hole Rigs

STOP RUST!

Resists Salt Air, Salt Water, Sun, Heat, Fumes, Blowing Dust and Sand—Yet Dries Quickly and Hard to a High Gloss Finish!

Do the job right in the field—right over the sound rusted surface! Just scrape and wirebrush to remove rust scale and loose rust — then brush or spray Rust-Oleum 769 Damp-Proof Red Primer (or H-50 Primer) over the remaining rust. Then—follow-up with the Rust-Oleum finish coat to match the original manufacturer's colors. That's all there is to it. Applied over rust—Rust-Oleum keeps your equipment looking better . . . LONGER!

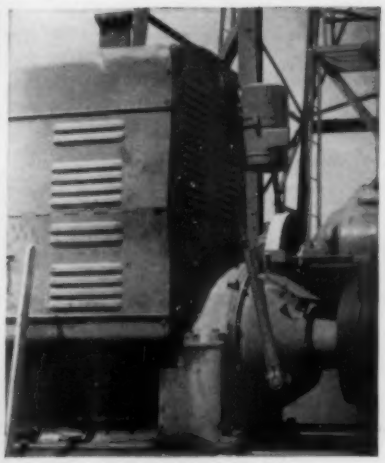
Rust-Oleum is *exclusive*, incorporating a specially-processed fish oil base that penetrates rust to bare metal. It dries right, is free of objectionable odor, is ready-mixed and self-leveling. Specify genuine Rust-Oleum. Accept no substitutes. Many leading industrial oil field supply distributors carry complete stocks for your convenience.

with

RUST-OLEUM®

and match original equipment

COLORS



FOR FREE TEST SAMPLE—ATTACH TO YOUR LETTERHEAD AND MAIL TO: RUST-OLEUM CORPORATION 2477 OAKTON ST., EVANSTON, ILL.

Please Send Me a FREE TEST SAMPLE to Match the Following Color: (check sample desired)

- ☐ Test Sample of 769 Primer to be applied directly over rusted surface
- ☐ Test Sample of CATERPILLAR YELLOW
- ☐ Test Sample of NEW NATIONAL BLUE
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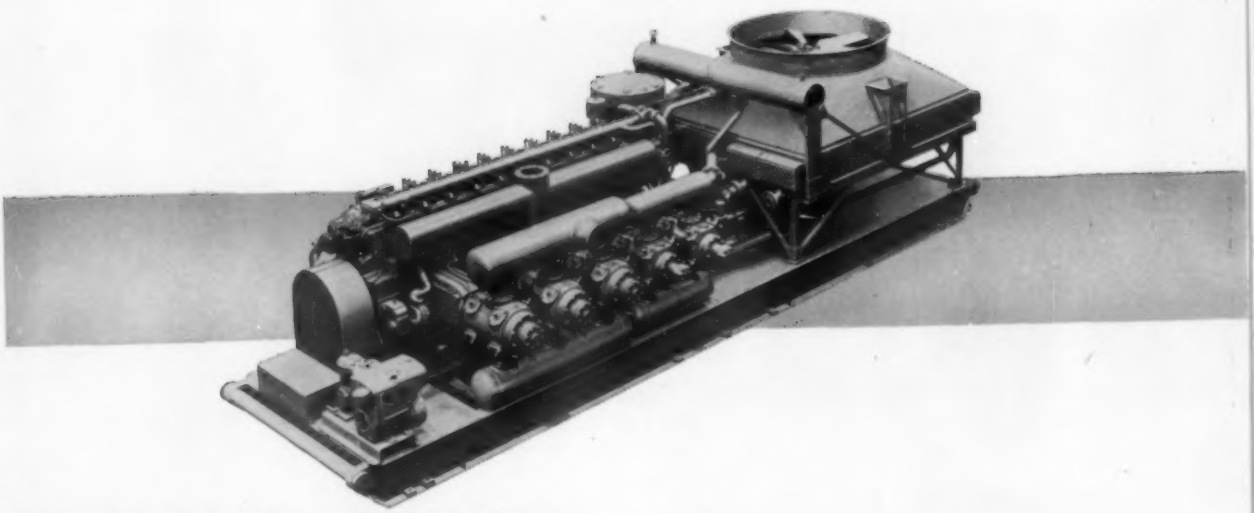
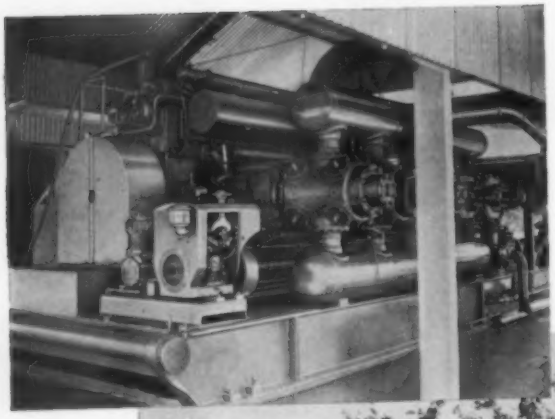
- ☐ Test Sample of NEW EMSCO GREEN
- ☐ Test Sample of BETHLEHEM YELLOW
- ☐ Test Sample of WAUKESHA GRAY
- ☐ Test Sample of OIL WELL ORANGE
- ☐ Test Sample of OLD EMSCO GREEN
- ☐ Test Sample of READY-MIXED ALUMINUM
- ☐ Test Sample of HIGH GLOSS WHITE
- ☐ Test Sample of QUICK DRYING BLACK
- ☐ Nearest Source of Supply
- ☐ Complete Literature and Color Charts.





"Highly

A performance report from
The La Gloria Corporation
on the First **Clark**
HMAB-10 "Midget Angle" packaged
compressor station installation

satisfactory"

Now over 7000 hours on stream

After 7000 hours of hard 24 hour a day service the performance of the first HMAB-10 Midget Angle installed is reported as being "highly satisfactory." There has been a complete absence of mechanical failures with only routine maintenance required.

The HMAB-10, installed at Waskom, Texas, is a completely self-contained packaged compressor station developing 550 bhp. The La Gloria Corporation is using it to gather gas at 50 psig. and compress it in two stages to 980 psig. Subsequent to after-cooling, the gas is piped to a gasoline plant where it is stripped and sold to a pipeline company.

Similar in appearance to the smaller HMA, the new unit incorporates the basic design features of the HMA as well as many new innovations. Foremost of these is a new radiator and hydraulic radiator drive. Both the radiator and drive have completely measured up to expectations with flawless operation.

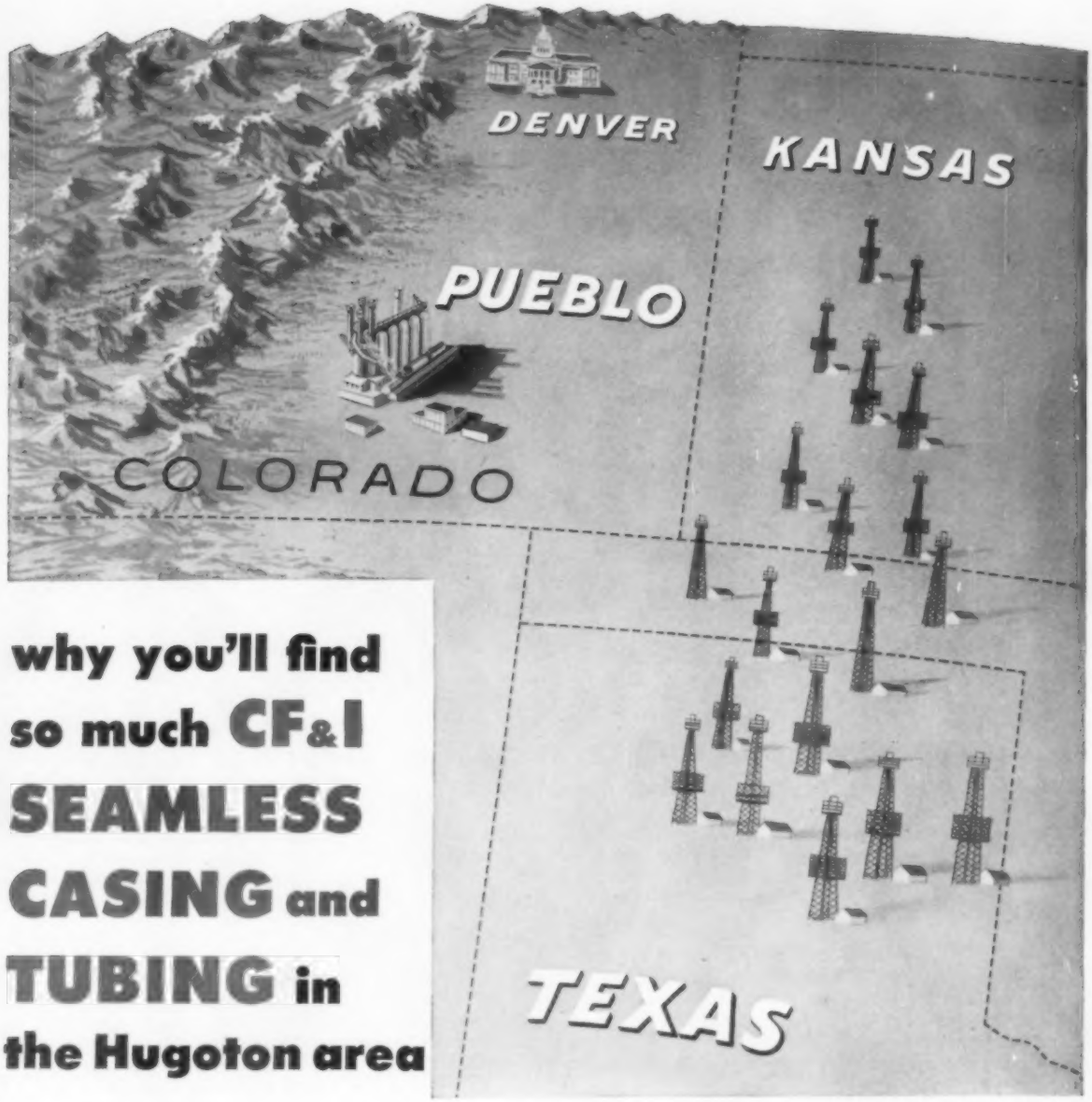
Substantial savings in erection time were realized at Waskom because the HMAB-10 was delivered as a factory tested, completely assembled unit. Balanced/Opposed design greatly reduced foundation needs.

One very important consideration for users of this 550 bhp. unit is the fact that it is equipped with five compressor cylinders as standard equipment. If field pressures drop excessively, conversion to three-stage operation is easily accomplished. There is also ample physical space in the radiator to add another cooling section for additional intercooling. Demand for this new unit is heavy but new production facilities will soon be ready to speed deliveries. Be sure to get all the facts on the HMAB from your nearest Clark representative.

CLARK BROS. CO., OLEAN, NEW YORK
One of the Dresser Industries
Offices in Principal Cities Throughout the World

CLARK®

Packaged Field Compressors



why you'll find so much CF&I SEAMLESS CASING and TUBING in the Hugoton area

Encompassing parts of four states, the Hugoton Embayment is one of the biggest gas and oil producing areas. Throughout this vast area, which is in close proximity to our Pueblo Mill, drillers and operators know the quality of CF&I Seamless Casing and Tubing. As a result, you'll see load after load of CF&I seamless oil country tubular goods that have proved their ability to give dependable, trouble-free service.

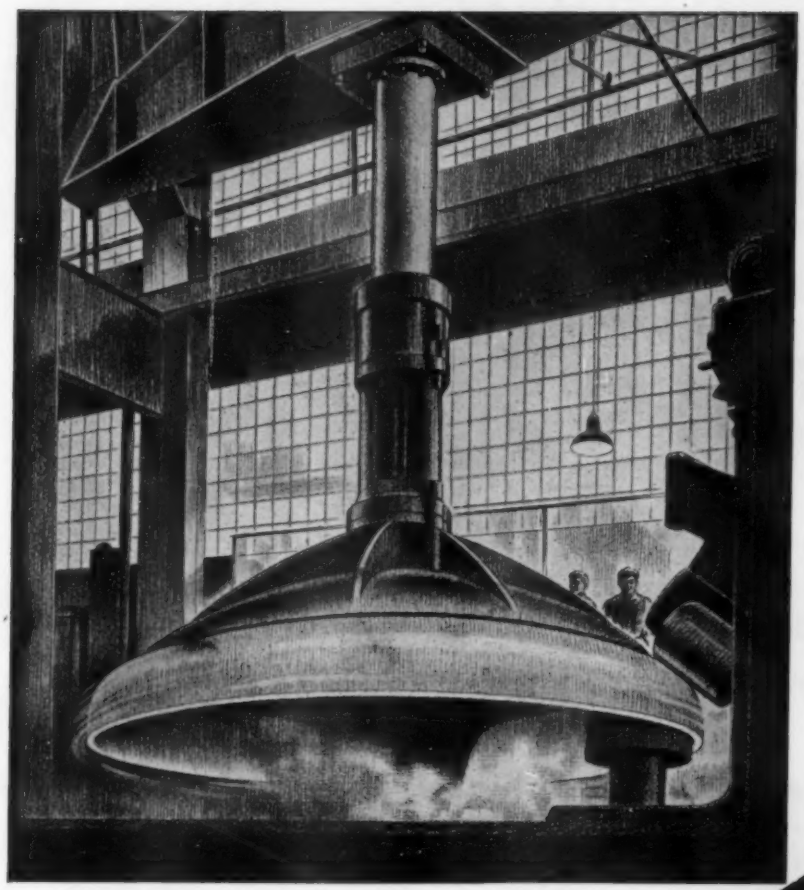
Meeting or exceeding API STD 5A specification, CF&I Seamless Oil Country Casing and Tubing is available in 2⅜" through 9⅝" O.D.

CF&I SEAMLESS casing and tubing API

4923

THE COLORADO FUEL AND IRON CORPORATION • DENVER, COLORADO

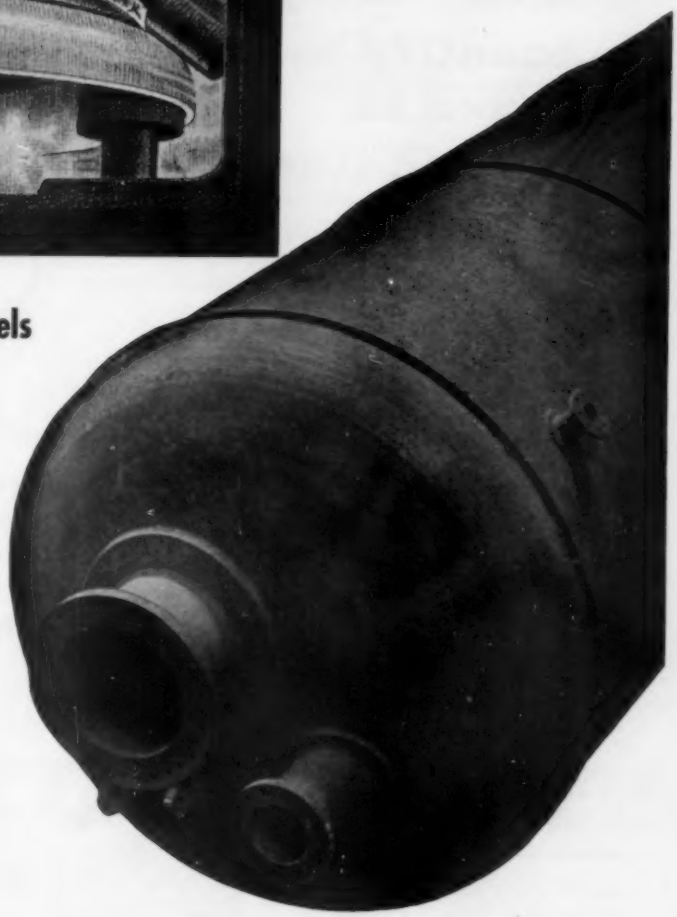
Spinning



SAVES METAL

—CUTS TOOL COSTS

The design and production of Pressure Vessels may be greatly facilitated by using dished and flanged ends spun by Harveys on the Rotarpress. They combine semi-ellipsoidal form with large knuckle radius. A substantial reduction in plate thickness can be effected, and in most cases tool costs are eliminated.



'Rotarprest' Ends for Pressure Vessels

can be supplied in Mild, Alloy and Clad Steels and Non-Ferrous Metals. The capacity of the Rotarpress ranges from 5 to 15 feet diameter, and ⅜″ to 4″ thickness. Knuckle radii and depth may be varied to meet individual requirements.

Please ask for List No. OG-965 giving full range of sizes.

Harvey

G. A. HARVEY & CO. (LONDON) LTD.
WOOLWICH ROAD, LONDON, S.E.7.,
ENGLAND. *Cables:* "Cheaper, London"

VOGT identification Disc...

...on top and in sight

makes it easy to identify valves —even in insulated lines

The Vogt tell-all identification disc, on every valve, is permanently located above the handwheel for complete and convenient identification. It shows valve size, catalog and drawing number, materials used for principal parts and primary pressure and temperature ratings. The flat on the handwheel protects the disc in assembly and in service.

Vogt GP Valves are available in a complete range of sizes from ¼" to 2", with HAYNES STELLITE* faced seating surfaces and rated 800 pounds at 850° F. and 2000 pounds at 100° F. (Other types are available through 8" size.)

*Trade-Mark of Union Carbide and Carbon Corporation

HENRY VOGT MACHINE CO.
P. O. BOX 1918, LOUISVILLE 1, KY.
SALES OFFICES: New York, Chicago, Cleveland, Dallas, Philadelphia, St. Louis, Charleston, W. Va.

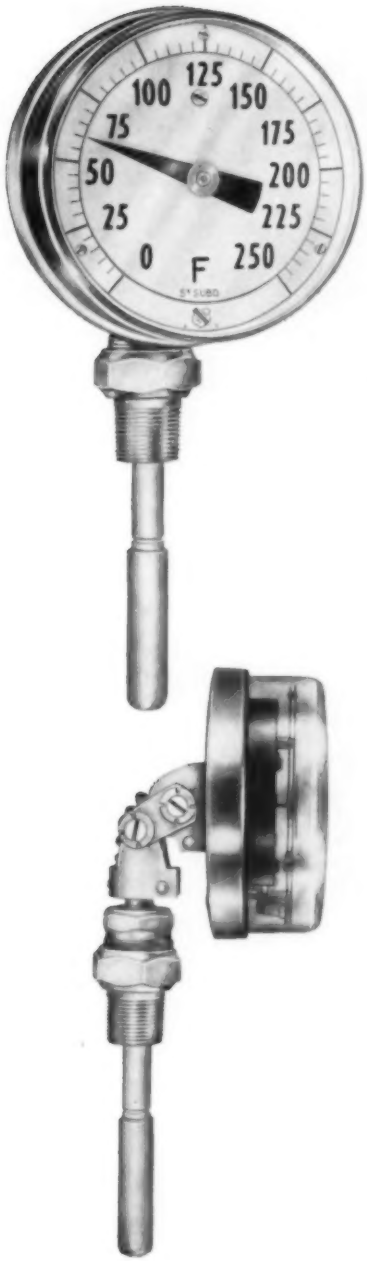
Write For Your FREE COPY of Supplement No. 1 to Catalog F-9. Address Dept. 24A-FO.

Vogt GENERAL GP PURPOSE Vogt FOR BETTER VALVES

DROP FORGED STEEL

VALVES

Adv. No. 7 in a series describing the features of Vogt GP Valves.



NEW

MERCURY ACTUATION

IN A MODERN 'AMERICAN'

"Every Angle" DIAL THERMOMETER

If you expect the most for your money in readability, accuracy and durability, here is the best dial thermometer investment you can make. The 'American' Mercury-Actuated "Every Angle" Dial Thermometer provides a combination of five major advantages found in no other thermometer:

"Every Angle" Set-ability. You can turn the dial to any angle within 180° on two axes. Whether installed above or below eye level — to the right or left of the reading point — you get easy face-to-face readings.

Fast, Accurate Indication. Mercury — one of the most sensitive heat transfer mediums — makes possible readings up to 1000° F. in a few moments with accuracy within 1% of the entire scale range.

Surest, Sharpest, Easiest Readings. The Maxivision® dial — a split-level dial — is constructed so that the graduations and pointer are on the same plane. No perspective effect. No parallax error in reading.

Best in Visibility. The cover is a large, durable, clear glass dome without bezel. No dark shadows dim the dial to hinder reading accuracy.

Stainless Steel Construction. Movement, capillary tubing, stem, case and cover mounting — all are stainless steel.

Where resistance to corrosion is important, where appearance and cleanliness are essential, the 'American' Mercury-Actuated "Every Angle" Dial Thermometer is ideal. It is rugged — has every quality required for the toughest services, indoors and outdoors. From the standpoint of economy, the "Every Angle" feature alone can save money in new piping specifications and when changing existing piping. It reduces the need to re-specify and stock a variety of fixed stem thermometers.

Dial Size: 4½". *Temperature Ranges:* −20/120° F. to 200/1000° F. *Stem Lengths:* 4", 6", 8", 12", 18" and 24". Separable sockets available.

YOUR INDUSTRIAL SUPPLY DISTRIBUTOR has complete information on the 'American' Mercury-Actuated "Every Angle" Dial Thermometer. Call on him to fulfill your requirements with fast delivery from local stocks.

1850 AMERICAN U.S.A.

AMERICAN INDUSTRIAL INSTRUMENTS

MAXWELL MANNING MOORE INC. MM&M TRADE MARK

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONN.

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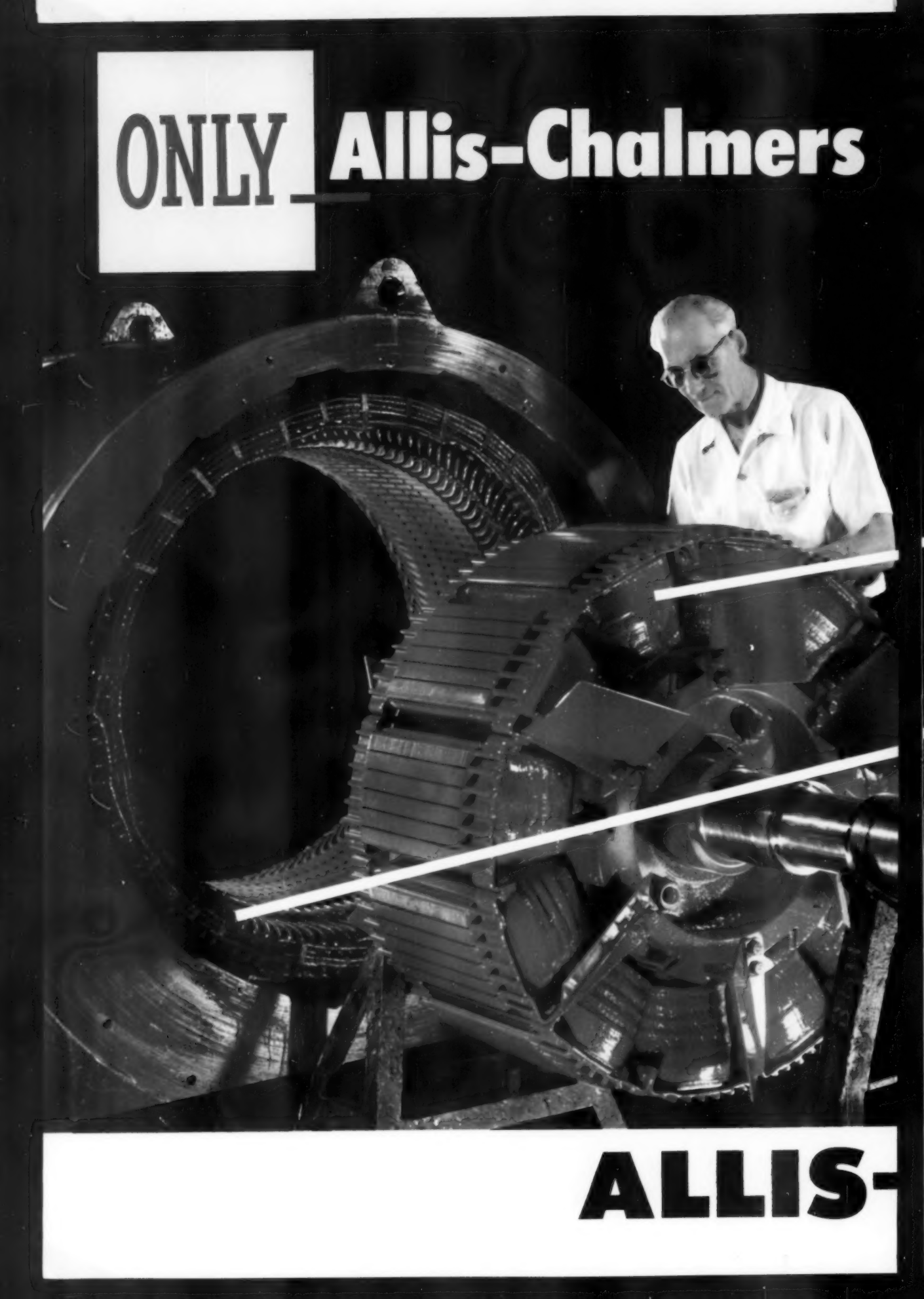
ONLY Allis-Chalmers



ALLIS-

MOTORS are "double protected"

New Integrated Field Coils Plus *Silco-Flex* Stator Insulation Provide Superior Motor Protection... Under Any Operating Conditions

1

Integrated Field Coils are bonded in heat-stabilized resins, enclosed in a resin-impregnated sheath of oriented glass fibers and bond-locked on the pole structure . . . dimensionally stable to withstand heating and thermal shock, vibration and fatigue at elevated temperatures . . . sealed throughout against atmospheric contaminants and fully protected against destructive forces.

2

***Silco-Flex* Insulation** provides a homogeneous, void-free insulating wall of silicone rubber on stator coils. It is unexcelled in life and thermal stability at high temperatures . . . resistant to most chemicals, water, weather . . . outstanding in flexibility and resilience . . . able to withstand abrasion and corona . . . resistant to physical and mechanical forces.

Exclusive Allis-Chalmers "double protection" is available on large electrical machines with operating temperatures through Class B range.

Silco-Flex is an Allis-Chalmers trademark

For more information on these quality insulation systems contact your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin for Integrated Field Coil Bulletin 05R8525 and *Silco-Flex* Insulation Bulletin 05R8341.

Allis-Chalmers "Double Protection," with integrated field coils and Silco-Flex stator coil insulation, adapts this 600-hp, 2300-volt, 600-rpm synchronous motor to the most severe operating conditions.

CHALMERS

A-C ALLIS-CHALMERS

A-5221

Early American Oil Man

The American Indian is credited with many firsts, to which should be added the discovery of oil in America.

True, it was Colonel Edwin Drake, who, in 1859, brought in the first oil well. But long before, the American Indian had learned to skim oil off certain streams that flowed through Pennsylvania.

To the Indians, oil was medicine . . . and although their precise medicinal use may not always have been appropriate, their idea was sound . . . for today oil is actually an ingredient in many drugs.

But far overshadowing its use for drugs and by-products is the use of petroleum to power a growing America . . . petroleum in the form of natural gas . . . petroleum in the form of advanced motor oils, greases, and gasolenes.

Here, above all else, Cities Service is proud to take its place as a leader . . . the only oil company that now offers totally new grades of gasolene for every type of car.

Literally fuels of the future, these new gasolenes are the crowning achievement of the finest men, methods, and multimillion dollar refining equipment. More importantly, they are part of a continuing series of petroleum "firsts" now offered and yet to come from Cities Service . . . for as America grows, so grows Cities Service, for nearly half a century, a leader in oil progress.

CITIES SERVICE

Metal to Metal Wear...

is the real villain in sucker rod pump troubles. It accounts for most of your repair and pump pulling expense.

The Martin Idea...

for getting away from this trouble has always been to make use of the best available materials — *Natural Rubber* for the key material in plunger rings; *Synthetic Rubber* for the key material in resilient ball guides for cages.

The accurately grooved and drilled metal body of **The Martin Plunger** does not touch the barrel. Only the resilient rubber and duck rings contact the barrel. This material — with its great natural resistance to abrasion as well as its slipperyness-when-wet — has a much slower wearing action on the barrel. Most often your barrel will not need replacing. These rings have an amazing ability to take the kind of abuse that goes with oil well pumping, and this means longer runs. Plunger cost is reduced because replacing the rings costs only about one fourth as much as a new plunger, and this saving is, of course, added to the barrel saving and longer runs.

Patent No. 2,591,174

The Martin Rubber Guide Cage protects the ball from all metal contact except when it rests upon its seat. The ball is protected to such an extent that ball and seat life is usually doubled. The synthetic ball guide and stop cannot beat out because of its resilience. Its life is therefore much greater than any metal and you get this longer cage life in addition to better ball and seat life. The two guides are easily replaced when the occasion does arise.

No real capital outlay is required to get these benefits because the cost of Martin Plungers and Martin Cages is very much the same as you are now spending for replacements — sometimes less.

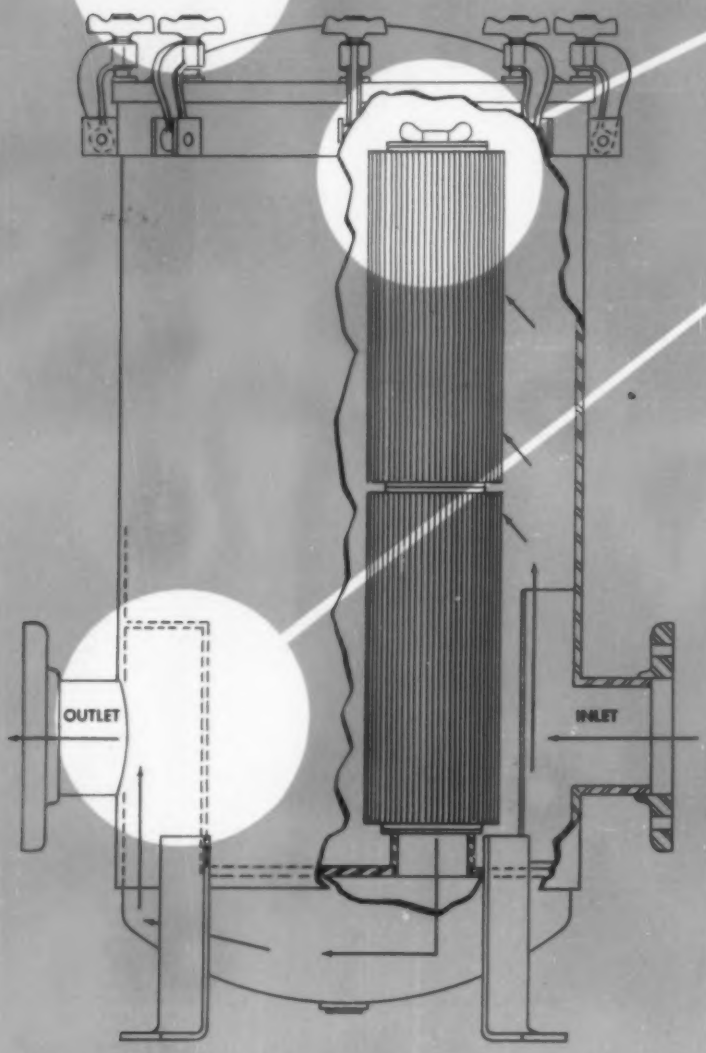
All regular or stroke-thru ROD PUMPS and TUBING PUMPS can be equipped with Martin Plungers. Martin Rubber Guide Cages are made in all sizes and styles. Write for our catalog No. 4; also see Composite catalog for 1956-57.

JOHN N. MARTIN

Manufacturer

9 W. BRADY • TULSA, OKLA.

NOW! In ONE Filter



Easy Servicing

Just a twist of the wrist and the top swings open. No special tools needed; eliminates nuts and bolts; no busted knuckles.

Best Performance

PETROLEUM MARKETING FACILITIES: truck loading racks, aircraft fueling, fuel oil bulk plants.

MACHINE TOOLS: coolants and cutting oils, hydraulic oils.

INDUSTRIAL PLANTS: solvents, oils, water and other non-corrosive fluids.

WITH THE

New Excel-So

57 SERIES FILTERS

Check these advantages • Simplified construction—low initial cost • Reduced size for compact installation • Quick opening cover and provision for instantaneous cartridge change • Improved filtration efficiency and greater dirt holding capacity . . . result . . . low cost maintenance • Very low initial pressure drop • Available for vertical or horizontal installation • Location of inlet and outlet connections to customer specifications • Wide range of product applications • Units in standard design or for code requirements • Non-ferrous construction available • Extra accessories including air eliminator, pressure gage, dump valve, etc., available.

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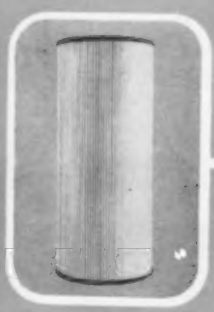


CH-57PL
PLEATED CARTRIDGE

THE NEWLY Developed
CH-57PL Cartridge combines

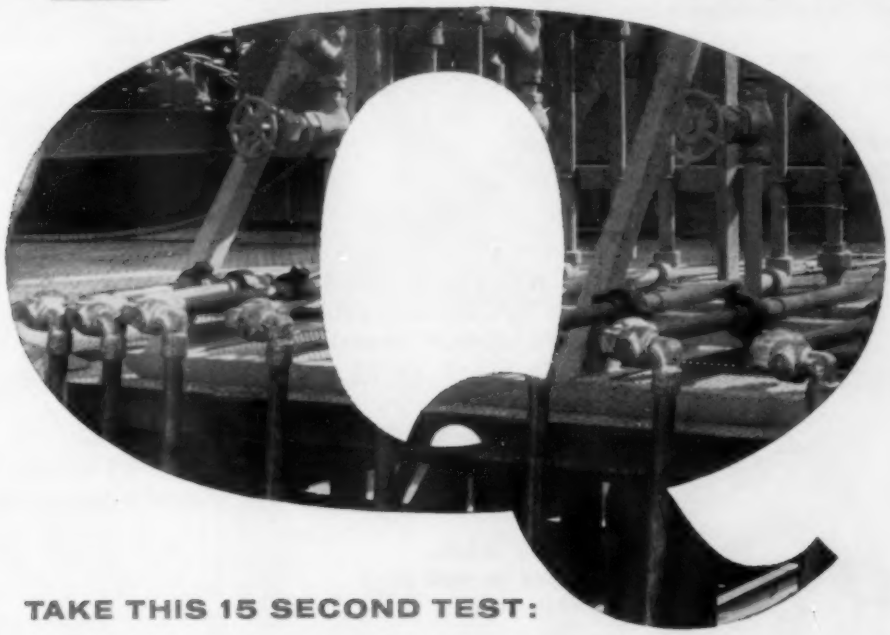
- Larger Outside Diameter
- Larger Inside Diameter
- Greater Height

RESULT

- More Filtration Surface
- Lower Operating Cost
- Higher Flow Rates

Write for bulletin WL-6-56

WHAT'S YOUR BLOWOUT PREVENTER HOOK-UP I.Q.?



TAKE THIS 15 SECOND TEST:

1. *How can line hookup time be kept to minimum?*
2. *What's the best way to overcome blowout preventer line stress fatigue?*
3. *What product insures full line flexibility with maximum safety?*

If your answer to each question was CHIKSAN Swivel Joints, you are at the head of the class. Chiksan Swivel Joints whittle hookup costs to rock bottom. Their durable service life under the roughest going is a matter of record. And their unequalled safety factor makes them the pride of the oil patch. Small wonder Chiksan Swivel Joints are considered the standard of the Industry for blowout preventer lines.

CHIKSAN

A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

fmc

FOR CATALOG WRITE DEPT. 34

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CHIKSAN COMPANY—BREA, CALIFORNIA • CHICAGO 5, ILLINOIS • NEWARK 2, NEW JERSEY

CHIKSAN EXPORT COMPANY • CHIKSAN OF CANADA, LTD., EDMONTON, ALTA.

1

NIAGARA FALLS, N. Y.
50% and 73% Liquid (in tank cars)

6 reasons why Mathieson CAUSTIC SODA is always there

2

SALTVILLE, VA.
50% and 73% Liquid (in tank cars)
76% Solid, Flake, Granular, and Ground (in drum shipments)

. . . an Olin Mathieson plant is near you.

. . . your source of supply is constantly backed up by five other plants.

For specifications and schedules, call your Olin Mathieson sales representative.

3

HUNTSVILLE, ALA.
50% and 73% Liquid (in tank cars)
50% Liquid (in barges)

4

BRUNSWICK, GA.
50% Liquid (in tank cars and barges)

5

McINTOSH, ALA.
50% and 73% Liquid (in tank cars)
50% Liquid (in barges)

6

LAKE CHARLES, LA.
50% and 73% Liquid (in tank cars)
50% Liquid (in barges and tankers)
76% Solid and Flake
(in drum shipments)

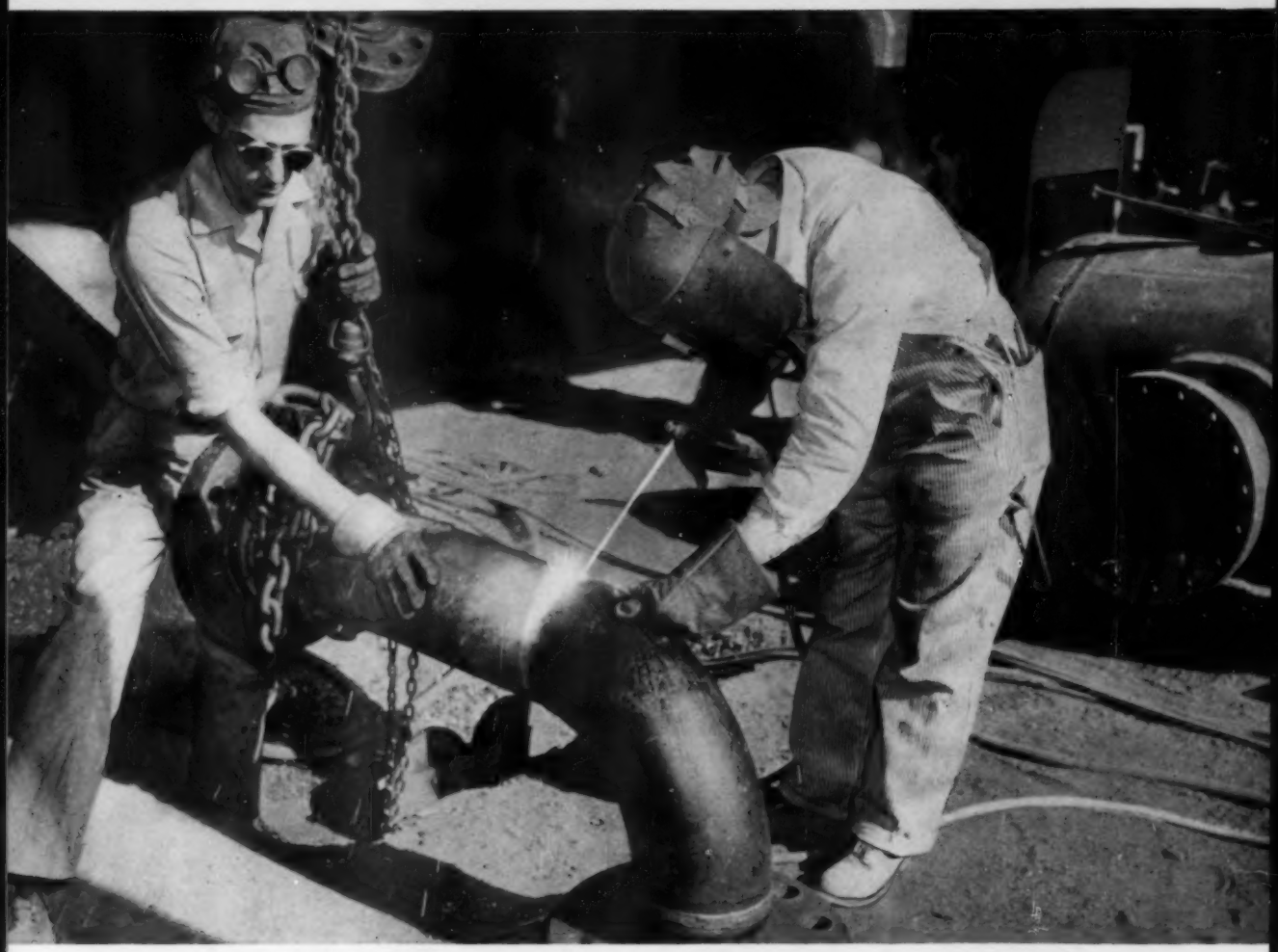
MATHIESON

MATHIESON CHEMICALS
OLIN MATHIESON CHEMICAL CORPORATION
INDUSTRIAL CHEMICALS DIVISION • BALTIMORE 3, MD.

INORGANICS: Ammonia • Bicarbonate of Soda • Carbon Dioxide • Caustic Potash • Caustic Soda • Chlorine • Hydrazine and Derivatives • Hypochlorite Products • Muriatic Acid Nitrate of Soda • Nitric Acid • Soda Ash • Sodium Chlorite Products • Sulfate of Alumina • Sulfur (Processed) • Sulfuric Acid

ORGANICS: Ethylene Oxide • Ethylene Glycols • Polyethylene Glycols • Glycol Ether Solvents • Ethylene Dichloride • Dichloroethylether • Formaldehyde • Methanol Sodium Methylate • Hexamine • Ethylene Diamine • Polyamines • Ethanolamines • Trichlorophenol • Surfactants

4920



When Specs Demand Job Matched Piping and Fittings One Call Will Do it All—B&W

The layout has been made. Erection schedules are in the planning stage. What you do now in contacting a source of supply for your alloy steel pipe fittings and flanges, can very well be one of your most important moves.

If you call on B&W, you can be assured of benefits that simplify scheduling problems. With one call to B&W—on one order—you can obtain matched pipe, fittings and flanges to meet your specific requirements. What's more—the delivery of the alloy steel pipe, the seamless welding fittings, and the forged steel flanges that make up the integrated system you desire—can be coordinated. This is just one more reason why B&W has earned the reputation and acceptance as "the natural source" for alloy pipe and fittings.

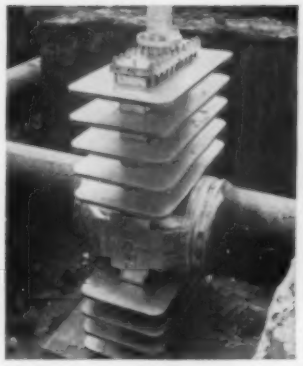
Call on Mr. Tubes at your nearby B&W Tubular Products Division District Sales Office—let him coordinate your alloy steel pipe, seamless welding fittings and forged steel flange problems. He can help you. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

TA-7009-PP3

Seamless and welded tubular products, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steel.

Perfect through-conduit alignment simplifies hot tapping through this 22" ASA 600 valve.

34" full opening high pressure gas valve will stay bubble-tight underground—with no lubrication or maintenance.



Ease of operation is of prime importance on frequently used manifold installations.

PERFORMANCE in the field points up the BIG DIFFERENCE

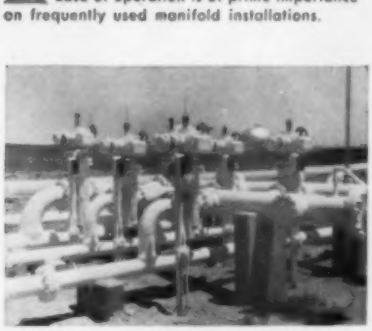
—in bubble-tight seal you can check in the line
—in easier operation with no wedging or jamming
—in lower maintenance with no need for lubrication
—in through-conduit always in line with the line

Thousands of pipeline, manifold and storage installations in gas and liquid services are daily adding to the record of performance that makes Grove *Seal-O-Ring* Gate Valves stand out as the practical answer to operating problems. If you have any doubt, ask men who are using them. It will pay you to specify Grove *Seal-O-Ring* Valves with the fabricated steel body—2" to 36"—in any standard pressure. Call your Grove representative or write today for details.

THE WHOLE VALVE IS RIGHT HERE

When valve is full open or closed, bubble-tight seals on both sides of the gate completely isolate line pressure in the conduit. The body, serving merely as framework for operating mechanism and to prevent loss of product while gate is in motion, may be drained or vented to atmosphere when gate is open or closed. Integrity of seals can be checked any time by a tell-tale valve on the body.

703



Products manifold at pipeline station illustrates typical motor-operated *Seal-O-Ring* Valve application.

LPG tank-to-pipeline is critical service where it's well to be able to check seal in the line—any time.

Self-cleaning feature is particularly important on crude oil tank lines.

GROVE SEAL-"O"-RING Gate Valves

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GROVE VALVE and REGULATOR COMPANY • 6529 Hollis St., Oakland 8, Calif.
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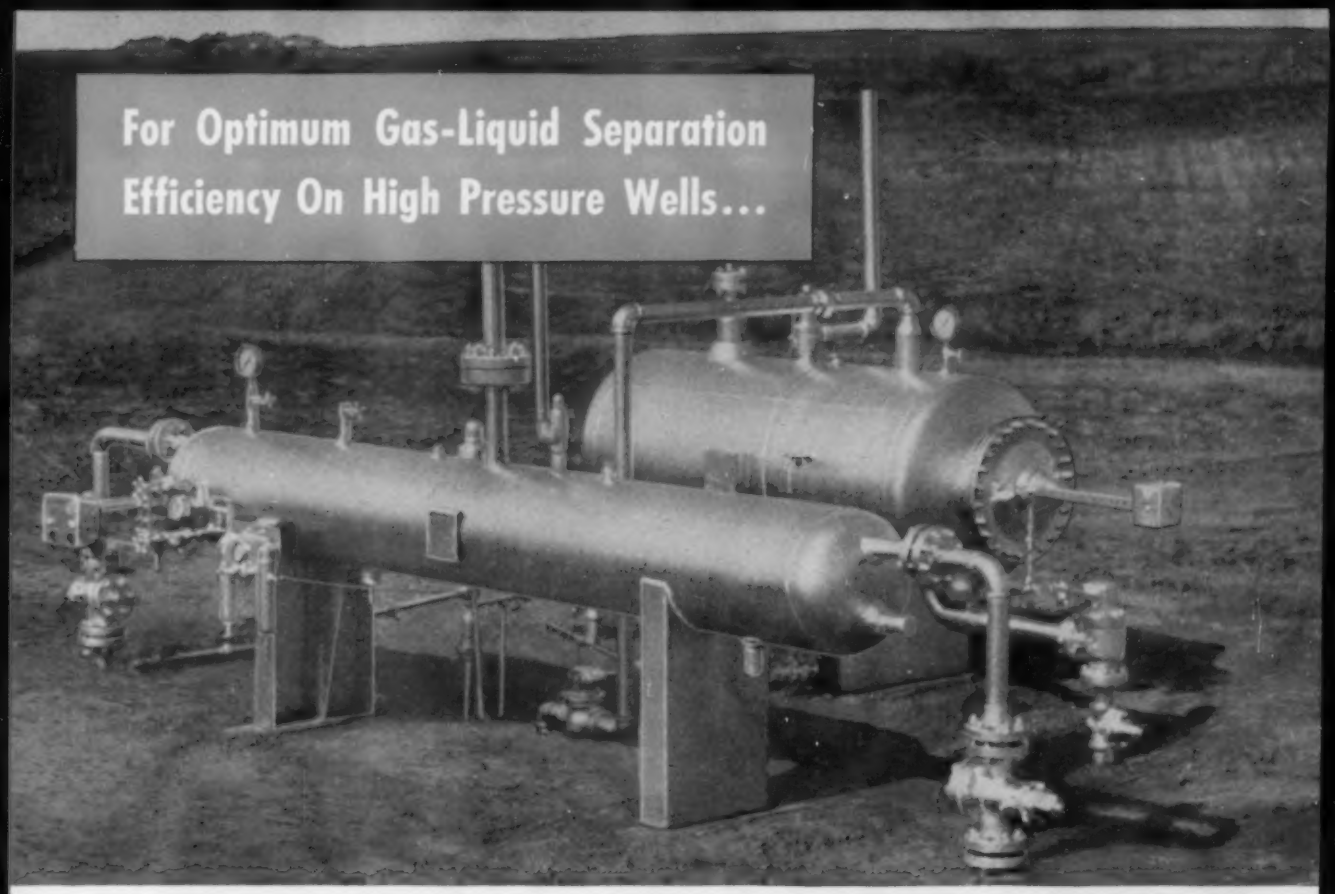
ODESSA, TEXAS • TULSA, OKLAHOMA • CHICAGO, ILLINOIS • DENVER, COLORADO • In Western Canada: GROVE VALVE LIMITED, EDMONTON



Specify

The BS&B Model DC Separator!

Because of its exclusive internal design incorporating a large gas-liquid separation chamber, a large liquid collecting and surge chamber, and a highly efficient mist extraction section all within its single horizontal cylinder, the Model DC Separator gives optimum separation efficiency on high pressure wellstreams.

Take the installation pictured above, for example. This Model DC Separator (foreground) is teamed up with a Model H Low Pressure Separator to form a two-stage hookup for processing the condensate-laden gas produced on a Kansas lease.

High gravity distillate is removed from the wellstream by the Model DC at approximately 60° F., and is then transferred to the Model H for further stabilization of the light ends at a reduced pressure of approximately 110 psi. Sales gas goes to the gathering line at 1000 psi, and condensate to the stock tanks at a pressure of 16 oz.

If you have a gas-liquid primary separation problem, why not get the facts on the Model DC from your BS&B Representative? Or you may write to . . .

MODEL DC SEPARATORS FEATURE...

- ✔ High Separation Efficiencies
- ✔ Proven BS&B Control
- ✔ Easy Serviceability
- ✔ "In-Line" Hookup
- ✔ Excellent Cold Weather Operating Characteristics
- ✔ Wide Selection of Shell Sizes
- ✔ Working Pressures from 500 to 7500 psi.

OVER 60 YEARS
BS&B
ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

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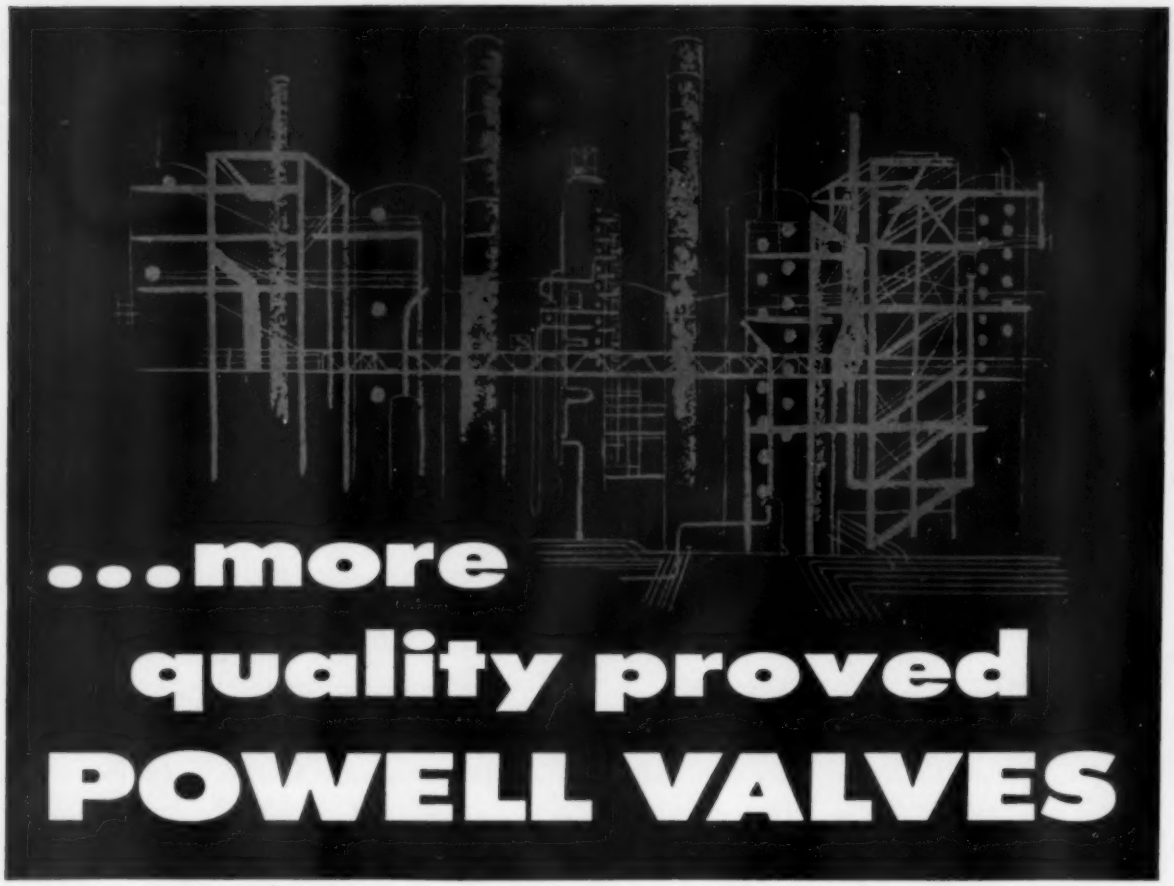


...more quality proved POWELL VALVES

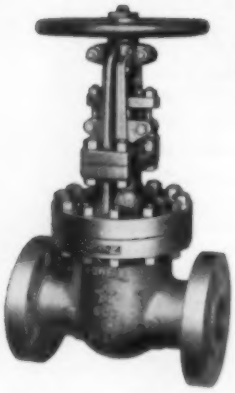


FIG. 6003 SS—Alloy Steel Gate Valve for 600 Pounds W.S.P.

FIG. 3061—300-Pound Steel Swing Check Valve.

FIG. 1563G—Gear Operated Lubricated Plug Valve, 150 Pound Steel.

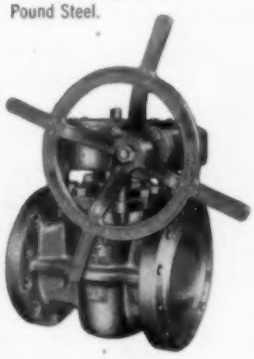
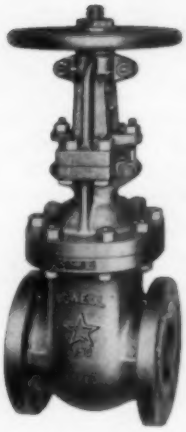


FIG. 1503—150-Pound Steel Gate Valve.



Designed for long life, designed for dependable service

Consult your Powell Valve distributor for all the facts about quality proved bronze, iron, steel and corrosion-resistant valves. For every flow problem . . . there is a Powell Valve to solve it.

THE WM. POWELL COMPANY, CINCINNATI 22, OHIO . . . 111th YEAR

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OIL FIELD ENGINES

FOR PRODUCTION PUMPING

Nordberg *POWER CHIEF* Gas Engines are low cost, medium speed units, ruggedly built for maximum economy on production pumping jobs where 'round-the-clock performance is a must.

Available in 1 and 2-cylinder sizes, up to 36 hp max., *POWER CHIEF* Gas Engines are simple to install and easy to maintain—ready to serve you 24 hours a day.

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More and more rigs are being lighted by Nordberg *POWER CHIEF* Diesel Generator Sets . . . because these sturdy units stand the gaff of continuous service, night after night, without constant attention and maintenance.

Built in 1, 2 and 3-cylinder sizes, from 10 to 45 hp, 6 to 30 kw—*POWER CHIEF* engines are available with special vibration-proof mounting for rig installation

NORDBERG MFG. CO.
Milwaukee, Wisconsin

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DIESEL and GAS ENGINES

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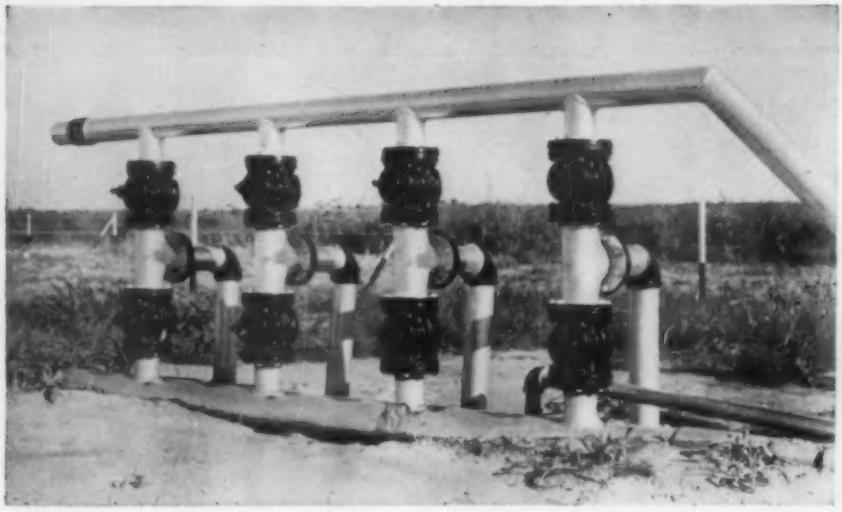
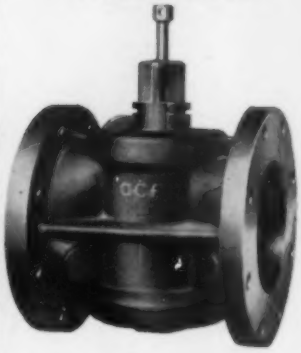
MEAD ENGINE & WELDING WORKS, Sterling, Kansas

CORNELISON ENGINE MAINTENANCE CO., INC., Seminole, Oklahoma

ROGERS DIESEL ENGINEERING CO., New Orleans, La.

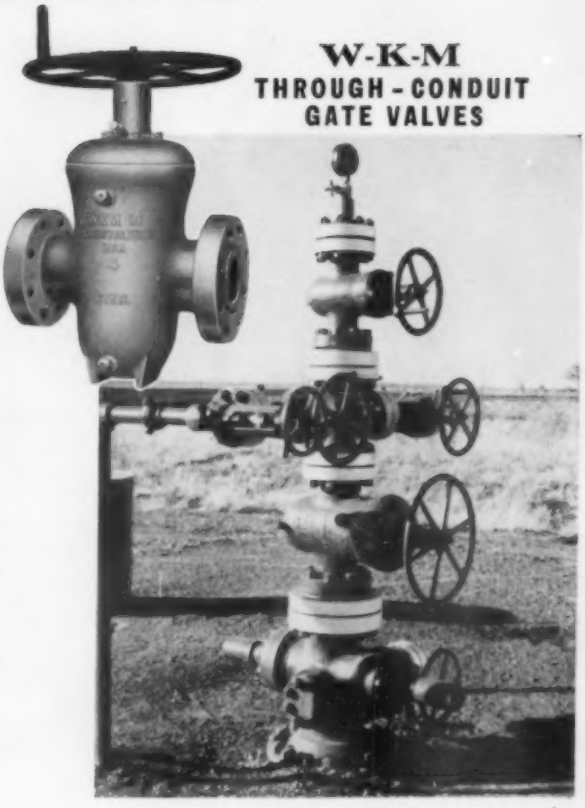


acf LUBRICATED PLUG VALVES



NOW-

Both High and Low Pressure Valves from W-K-M



W-K-M THROUGH-CONDUIT GATE VALVES

For your Christmas Trees, flow lines, and wherever else high pressures must be safely and positively controlled, there are the famous W-K-M- through-conduit gate valves, in working pressures from 1,000 to 15,000 pounds.

acf lubricated plug valves, of steel, semi-steel, and special metals, with round or rectangular ports, in working pressures from 200 to 500 pounds — are the perfect companion valves for gathering lines, manifolds, headers, and similar low pressure installations.

Because you need the finest in service wherever valves are required, you will be way ahead when you specify W-K-M or acf valves for their respective applications.

5605

W-K-M

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W-K-M THROUGH-CONDUIT GATE VALVES	acf LUBRICATED PLUG VALVES	KEY RETURN BENDS AND FITTINGS

is Beacon's secret of success in the marketing of petroleum products . . .

Like plotting a ship's course — petroleum products marketing is a specialized business and requires careful planning — to build steady customers. Beacon's reputation of never letting a customer down means a steady outlet for refiners — and a constant source of supply for dealers. Whether you are buying or selling petroleum products — Beacon can chart a course for you that will mean bigger profits.

BEACON PETROLEUM COMPANY

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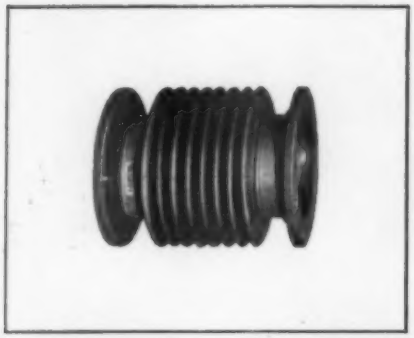
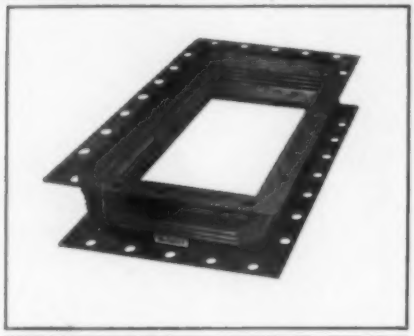
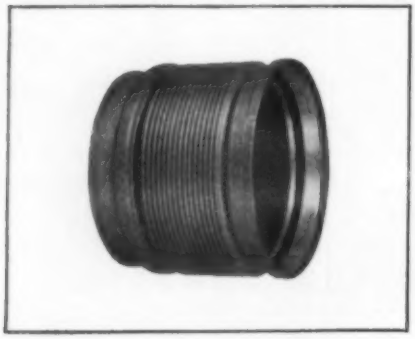
BEACONGAS

Marketers of Natural Gasoline, Butane-Propane, Motor Fuel, Fuel Oils







SOLA-FLEX®

EXPANSION JOINTS AND BELLOWS ARE MADE IN ALL SIZES AND VARIETIES

Write for Catalog

THE SOLA-FLEX LINE is the most comprehensive in the world. It includes many basic types of expansion joints—convoluted, U-span, rectangular, and others. Sizes range from ½ in. to 35 ft in diameter. Pressure ranges run from complete vacuum to standard 900 psi test and to higher pressures on special designs. Bellows have been built for service from—300 F to 2000 F. Materials used include all types of steels and a variety of high alloys.

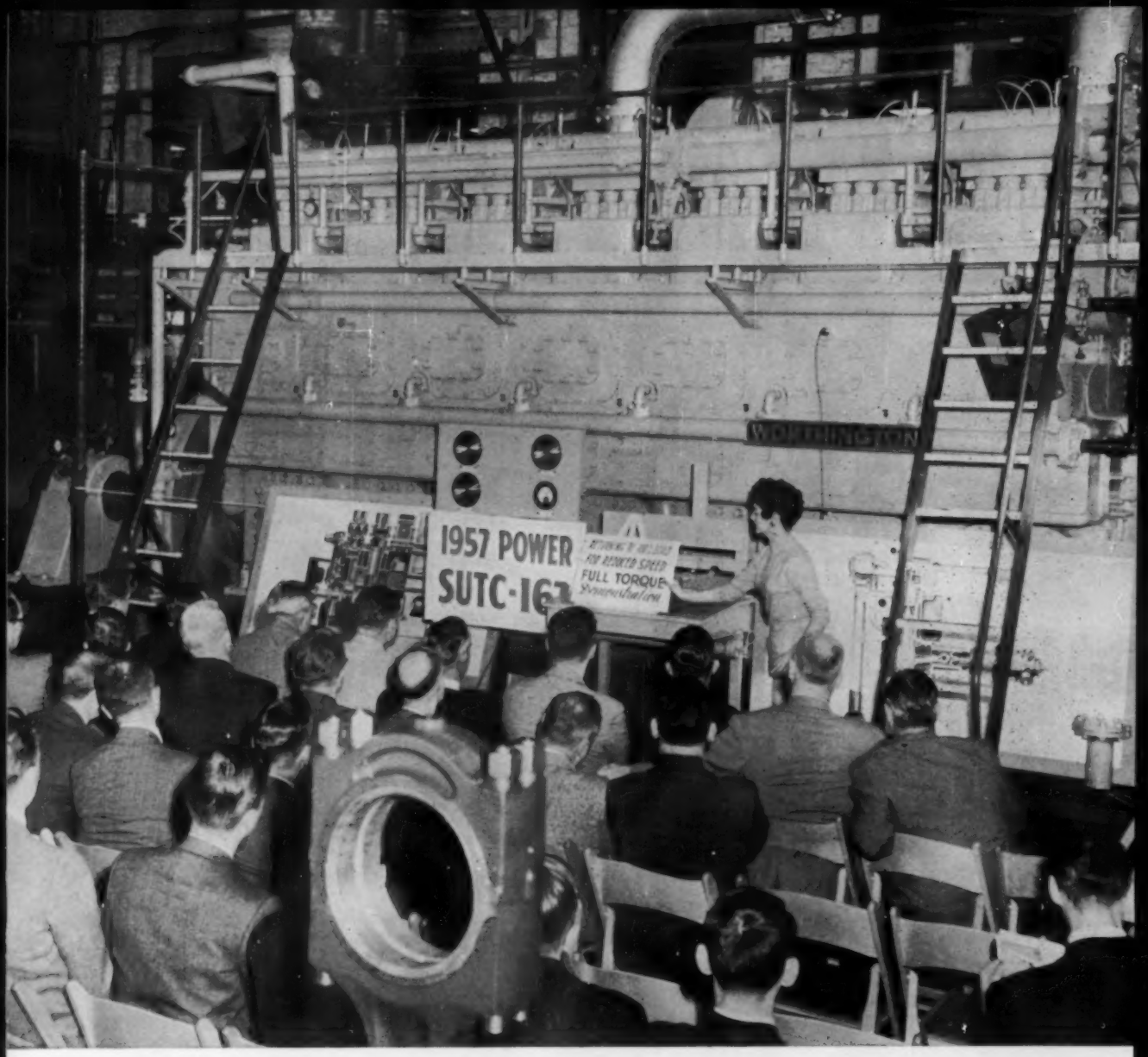
Pipe expansion problems increase with higher pressures, temperatures and smaller space. Sola-Flex joints provide the answer—with economy and efficiency. Write for catalog today. Dept. C-153, Solar Aircraft Company, San Diego 12, California.

SOLAR

AIRCRAFT COMPANY

SAN DIEGO DES MOINES

DESIGNERS, DEVELOPERS AND MANUFACTURERS OF GAS TURBINES - AIRCRAFT AND MISSILE COMPONENTS - BELLOWS - CONTROLS - HIGH TEMPERATURE COATINGS - METAL ALLOY PRODUCTS



At 1957 Power Fair, engineers witness proof of...

TURBO-UNIFLO PERFORMANCE

There's no better way to judge the performance of an engine than to see it in operation. That's why more than 250 process and pipeline engineers recently gathered in Buffalo, N. Y., to attend Worthington's 1957 "Power Fair."

Star of the show was the new SUTC TURBO-UNIFLO gas engine compressor. The only two-cycle engine compressor with exhaust powered turbocharging from start-up through full-load, the TURBO-UNIFLO features remarkable stability over the complete range of speed and load requirements.

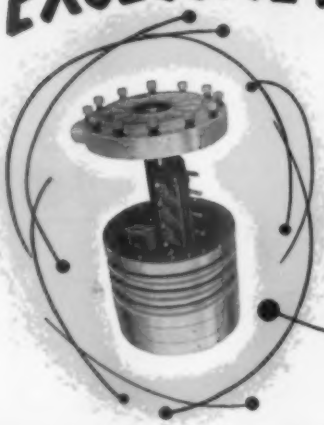
The audience was impressed by the TURBO-UNIFLO's smooth start and quiet operation (as much as 20 decibels quieter than engines with mechanically driven scavenging systems). Next came the overload demonstration to prove the very conservative engine rating.

To show stability, engine speed was gradually reduced while maintaining full torque. 320 rpm . . . 270 rpm . . . 230 rpm (at this point someone offered to bet that it couldn't go below 150). But down it went . . . all the way to 105 rpm before reaching its stalling point.

But this is only half the story. Your Worthington representative will be glad to give you all the facts about the new SUTC TURBO-UNIFLO engine. Get in touch with your nearest Worthington district office or write to Section E-73, Worthington Corporation, Harrison, N. J. In Canada: Worthington (Canada) 1955, Ltd., Brantford, Ont. E-73

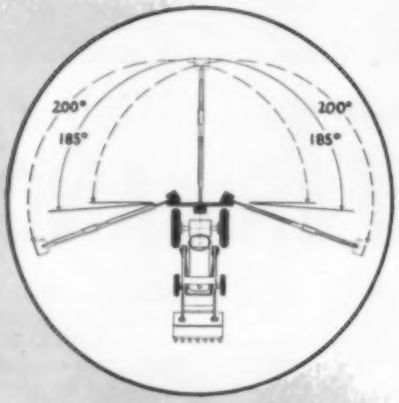
WORTHINGTON

EXCLUSIVE!



NEW HYDRAULIC ROTARY BOOM SWING CYLINDER

DISCOVER DAVIS ...AND WHY IT WILL DO WHAT NO OTHER BACK-HOE CAN DO!



PROVIDES 200° CONTINUOUS OPERATING ARC

This diagram illustrates the degrees of continuous operating arc from each of the three mounting locations — 200° when side mounted, or 185° center mounted. Has no pins to change or cable to break.

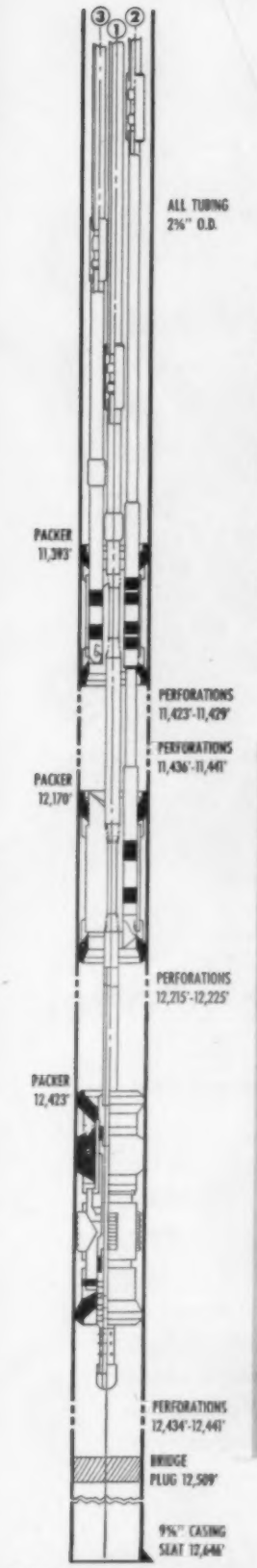
FLUSH DIGGING... with a 200° continuous operating arc... that's what the new Davis Model 210 does that no other machine can do. It will dig flush alongside buildings, fences, and other installations where you normally have to dig by hand! The exclusive hydraulic rotary boom swing cylinder and interchangeable mounting points on the frame are the key to its profit-making operation. The simple, compact cylinder with only one moving part replaces conventional swing rams, cables, and the inherent limitations as employed by all other back-hoes. The entire mast and boom assembly can be moved from center to either side for flush digging. It has smooth starts...cushioned stops, and because hydraulic pressure is constant, it permits a steady, controlled swing all the way around. This, plus all the other features that have made Davis America's largest selling back-hoe – right-angle operation, rotary seat, vertical stabilizer, 13' depth, and ***7,000 pounds of breakaway*** mean more jobs...more profit...less time on each job. Get complete information on both the new 210 and the popular 185 Davis Back-hoes today. Available for most popular tractors and 1-ton or larger flat-bed trucks.

Davis Back-hoes and Loaders are sold and serviced everywhere in the U. S. A. and Canada by better dealers!

FOR THE NAME OF YOUR NEAREST DEALER CALL WESTERN UNION BY NUMBER, AND ASK FOR OPERATOR 25 ... *or write direct*

MID-WESTERN INDUSTRIES, INC.
1009 SOUTH WEST STREET DEPT. OG WICHITA 15, KANSAS

America's "first" triple-completion well depends on NATIONAL SEAMLESS STEEL TUBING



Schematic of Triple Completion

•About five miles northeast of St. Martinsville, Louisiana, stands the country's most unique Christmas tree—that of *America's first* high-pressure, triple-completion well. This single Christmas tree tops off three strings of tubing to permit simultaneous, but separate, production from three different zones.

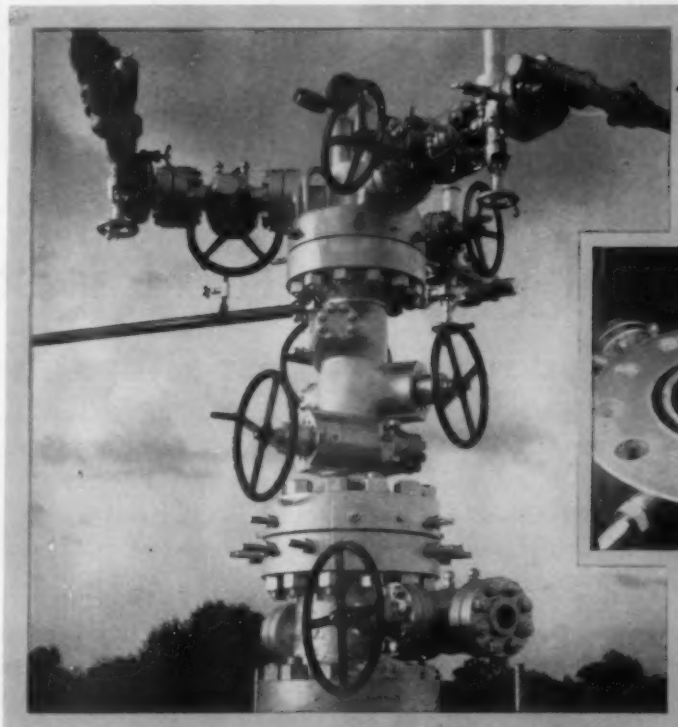
Owned by Aluminum Company of America, Mining Division, the triple well serves the same purpose as three singles, at a fraction of the cost.

The well is bottomed at 12,646 feet, where 9⅝-in. National Seamless Casing was set. Oil, rated at between 40 b/d and 60 b/d of 35.4 gravity, is produced from two perforation intervals in the top zone—11,423-29 ft. and 11,436-41 ft. Gas is produced from the second and bottom zones—12,215-25 ft. and 12,434-41 ft., respectively.

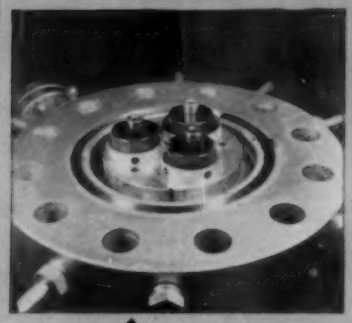
Approximately 35,949 feet of 2⅜-in. National Seamless Tubing were used in the three strings. The top zone tubing pressure was 3150 lbs. The three strings were suspended in a triple tubing head spool and triple bore parallel string tree. The setting is designed so that each tubing string can be pulled independently.

National Seamless Oil Country Tubular Products are habitually chosen when the job has to be done "just right." No matter how rigorous the conditions, National Seamless products promise trouble-free dependability. The seamless process of manufacture gives them unsurpassed uniformity and strength, the best defense against high pressures, vibration, fatigue, twisting action, and collapse.

For more complete information, write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pennsylvania.



Three flow lines off Christmas tree permit separate production of gas and oil from three different zones.



Three strings of tubing show at top of head spool.

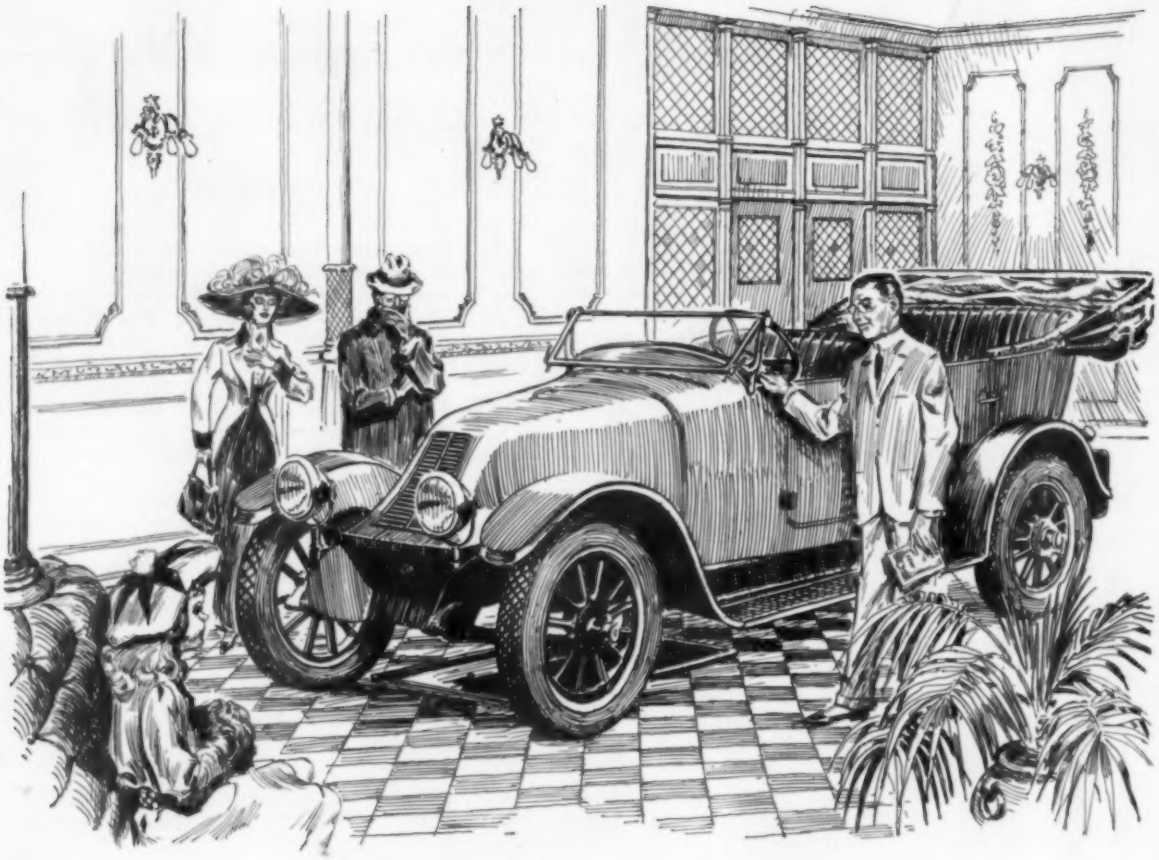
WALLS WITHOUT WELDS

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

NATIONAL USS SEAMLESS

DRILL PIPE . . . CASING . . . TUBING

UNITED STATES STEEL



The Thrill of Owning the Latest Model

. . . WHEN UOP DEVELOPED ITS FIRST REFINING PROCESS

The proud buyer of this new model Franklin back in 1915—the year UOP first made its thermal cracking process available—was just as excited about it as the new owner of one of today's streamlined, super-powered cars.

Through the intervening years, as new model superseded new model, Universal has gone steadily forward developing new and improved refining processes, making them available to refiners everywhere, helping the industry to provide the constantly better motor fuels essential to progress in automotive performance.

Today, refiners all over the world depend on UOP for the processing methods and techniques required to improve their products . . . and to make more of them, better and cheaper, so that they can be universally used and enjoyed.

UNIVERSAL OIL PRODUCTS COMPANY
30 ALGONQUIN ROAD, DES PLAINES, ILLINOIS, U.S.A.
Forty Years Of Leadership In Petroleum Refining Technology

US RUBBER PACKINGS

SIMPLIFY YOUR PACKING PROBLEMS

these 6 packings will handle most of your requirements

STYLE 193

STYLE 193—U. S. CENTRIFUGAL PUMP PACKING

For centrifugal pumps, or other rotating or oscillating rods or shafts, handling hot or cold, fresh or salt water, oil, brine, weak acids, caustic solutions and ammonia. Made of long fibre asbestos yarn, plaited square. Each strand thoroughly lubricated and graphited.

STYLE 101—U. S. RAINBESTOS HIGH-PRESSURE ROD AND PLUNGER PACKING

Designed for high-pressure steam, air and gas up to 500° F. Made from selected asbestos cloth, woven from tightly twisted asbestos yarn, with a genuine U. S. Rainbow non-hardening cushion, formed square, and treated with heat-resisting lubricants and preservatives and with a graphite solution.

STYLE 101

STYLE 16010—DUCK AND RUBBER

STYLE 16010—U. S. MATCHLESS PACKING

Matchless is the high-pressure packing—will withstand hydraulic pressures as high as 8000 pounds. Self-adjusting, automatic action results in reduced wear and tear on rods and plungers, minimizes friction, keeps down packing costs. For hydraulic equipment, presses, rams, triplex pumps, outside packed pumps, and swivels on rotary drilling rigs.

STYLE 463—U. S. PEERLESS CANVAS PUMP PACKING

For service on inside packed pumps against hot or cold water, and for end rings in hydraulic sets. Made from first quality, closely woven duck laminations cemented together with a high quality rubber friction. Light in weight.

STYLE 463

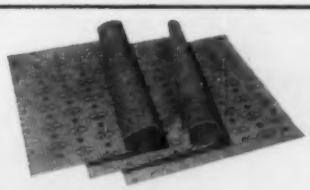
STYLE 125

STYLE 125—U. S. WIZARD ROUND BRAIDED ASBESTOS PACKING

For use in valve stems, reciprocating rods and plungers, against steam, air, hot and cold water, ammonia, oil, chemicals and some acids. Made of long fibre asbestos yarn, braided in round cross-section in the braid-over-braid construction, thoroughly lubricated and graphited throughout.

STYLE 899 (F.O.P.)—U. S. COMPRESSED ASBESTOS SHEET

F.O.P. (Fibre Oil-Proof) is the original oil-proof asbestos fibre high-pressure sheet developed especially for oil industry conditions. Recommended for packing flanges or joints against superheated or saturated steam, air, ammonia, gases, oil, gasoline, water, some acids, alkaline solutions and other chemicals. Ideal for Still Head gaskets. It will not soften, burn, blow or ooze out of a joint, and does not deteriorate with age in stock.



STYLE 899 (F.O.P.)

US RUBBER **Mechanical Goods Division**

United States Rubber

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ENGINEERING CORPORATION

HOUSTON, TEXAS

LET FISH GO WITH YOU EVERY STEP OF THE WAY

The Fish Companies have played a vital role in some of the most important projects of the postwar era. Forethought and vision are apparent in every project. Fish economists, engineers and construction men lead the way—every step of the way.

Affiliated Companies

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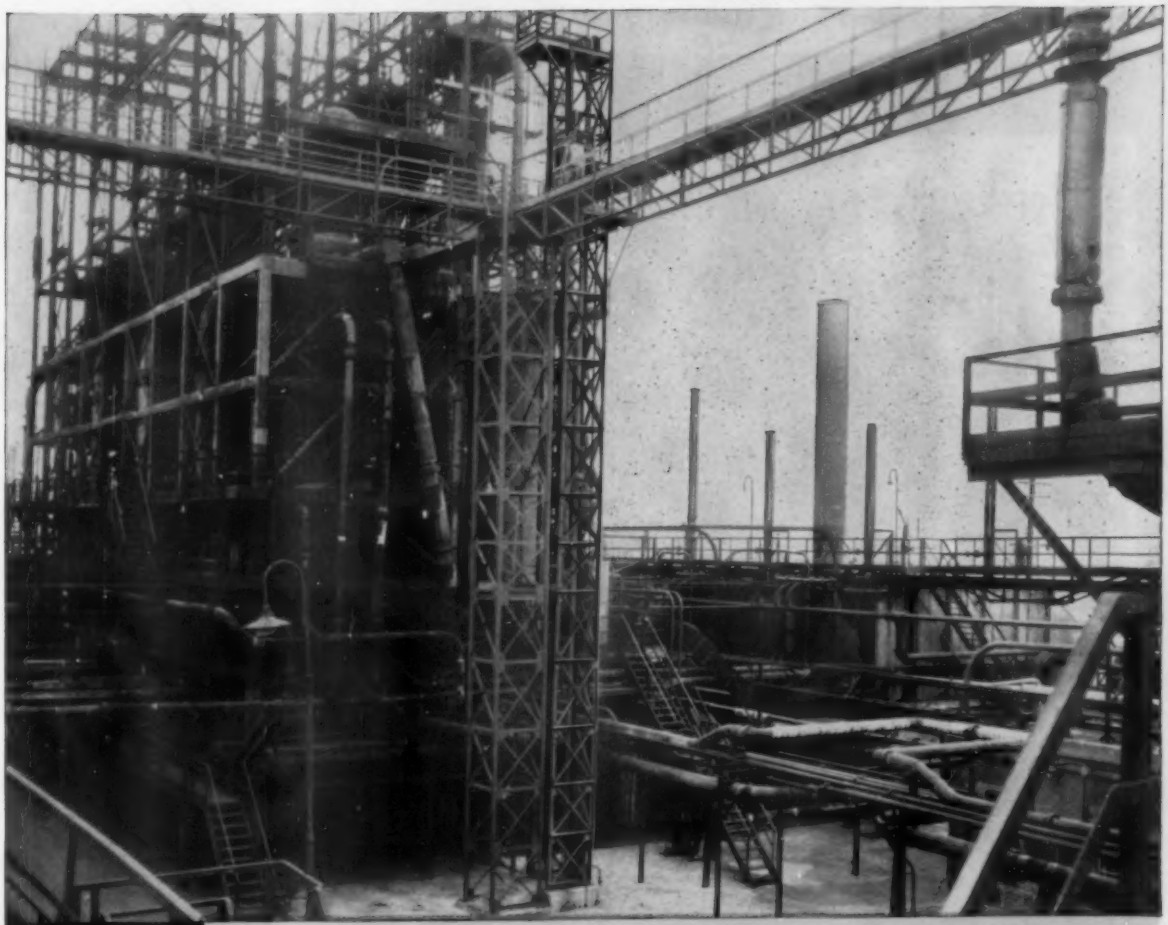
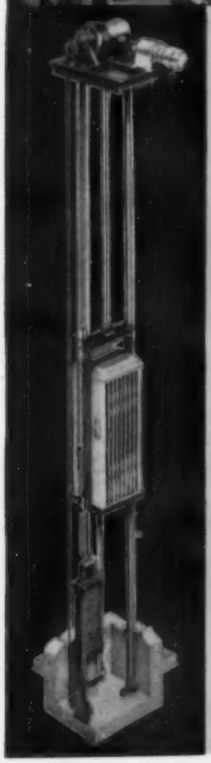
FISH NORTHWEST CONSTRUCTORS, INC.



A typical installation of an EHRSAM ELEVATOR at a Gulf Coast refinery.



Safe, Low Cost EHRSAM
ELECTRIC ELEVATOR FOR "CAT" CREWS

FACTS:
Complies with American Standard Safety Code, all state and local codes. Machinery and cab can be furnished galvanized for outdoor installation . . . lift rate, 90 ft. per minute. For special applications, speeds of from 50-120 ft. per minute are available.

SIZES:

2'3" x 2'3"	— 300 lb. capacity	(1½ Hp.)
2'9" x 2'9"	— 500 lb. capacity	(2 Hp.)
4' x 4'	— 1000 lb. capacity	(3 Hp.)
4'6" x 6'	— 2000 lb. capacity	(7½ Hp.)

Maximum lift 250 feet. All-metal car with collapsible door. Magnetic brake. Emergency exit and safety door. Rigid, electric-welded all-steel frame.

All components factory assembled and pre-tested for easy installation. Complete operating instructions and detailed drawings included with each unit. Furnished with all elevator safety equipment required by code. All electrical equipment can be furnished explosion proof for either 220 or 440 volts.

WRITE, WIRE OR PHONE FOR ILLUSTRATED BROCHURE AND LIST OF EHRSAM ELECTRIC ELEVATOR CUSTOMERS.

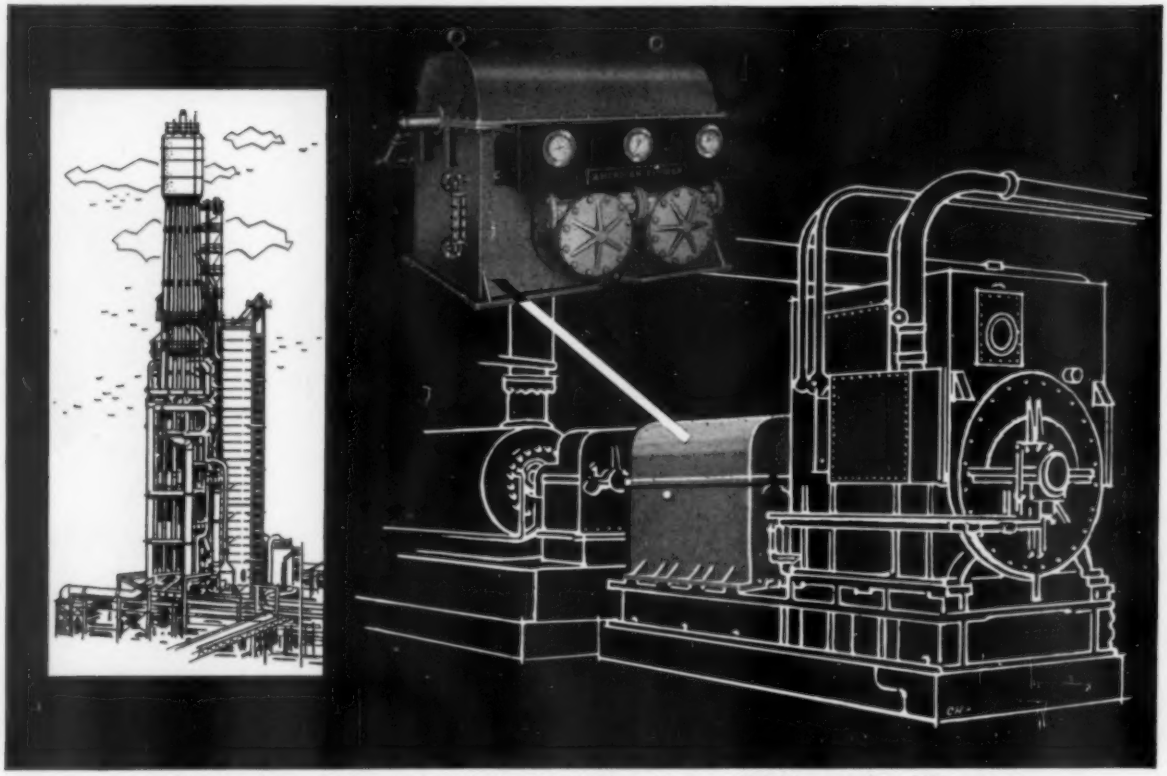
Push-button, car-type for 1 to 6 passengers. Easy to run, inexpensive to operate, simple to install.

EHRSAM®

THE J. B. EHRSAM & SONS MFG. CO.
DEPT. OG, ENTERPRISE, KANSAS
"OVER 80 YEARS OF DEPENDABLE SERVICE"

SALES OFFICES: Denver, Colorado; Fort Worth, Texas; Kansas City, Kansas.
WEST COAST: Ehrsam Pacific, Inc., Riverside, California.

AMERICAN BLOWER *Gýrol*® FLUID DRIVE . . .



Class 4 and Class 6 (shown), Type VS Gýrol Fluid Drives, 100 hp to 12,000 hp, speeds to 3600 rpm.

Here's how accurate pump and compressor control solves varying flow problems at refineries

Problem: how can refineries simplify and control the flow of gases and fluids of various densities and temperatures? Solution: an American Blower Gýrol Fluid Drive that permits smooth, shockless speed and torque adjustments between motor and load!

Catalytic reforming processes – You can vary the flow rates of pumps and compressors of all sizes and types – as needed – with the adjustable-speed feature of the Gýrol Fluid Drive. What's more, the Gýrol unit simplifies starting equipment, even provides no-load starting.

Centrifugal and positive displacement pumps – The combination of a Gýrol Fluid Drive and a constant-speed induction motor provides stepless, adjustable speed for flow control of centrifugal and positive displacement pumps – without throttling valves! You get the same flexibility and adjustable flow as obtained with a steam turbine.

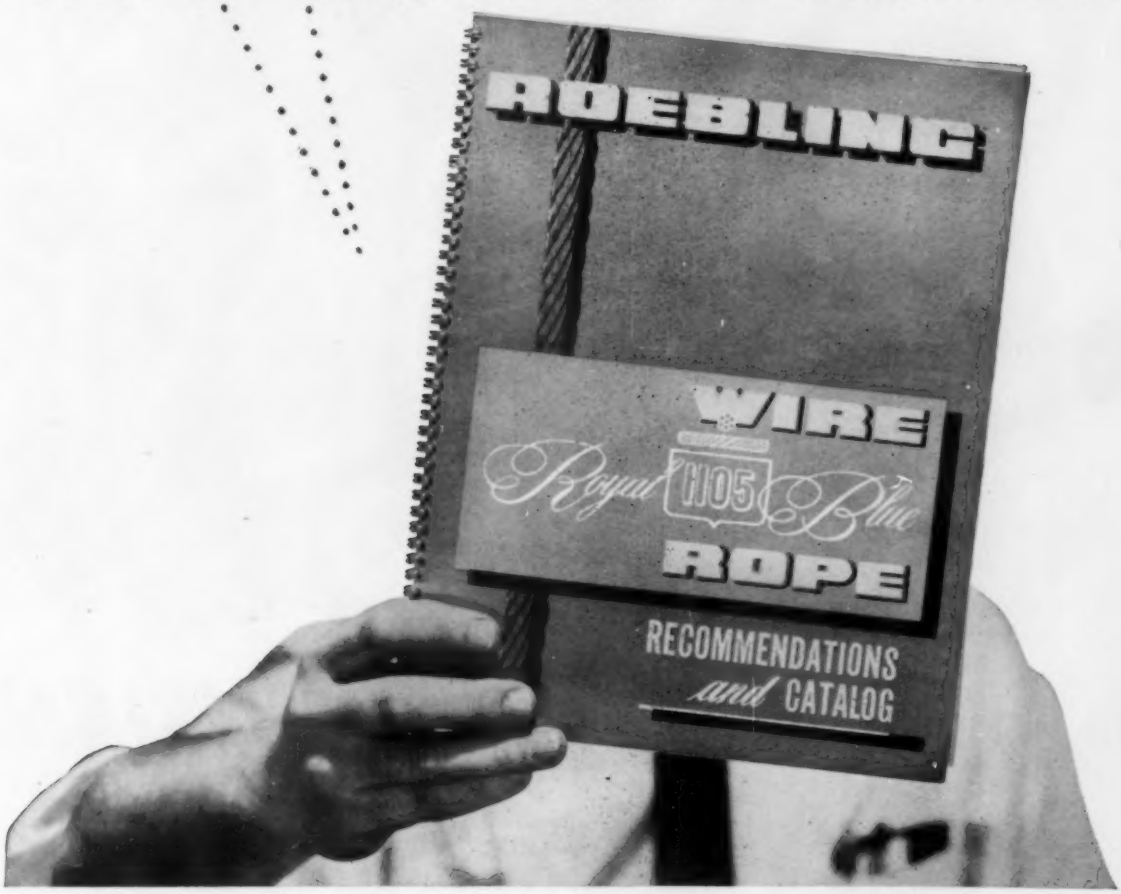
Catalyst rejuvenators – Gýrol Fluid Drives are a big help to this and other refining operations requiring high-inertia starts. The smooth, shockless power transmission satisfies tough drive requirements; lets you engage the load with engine at full rpm, or permits across-the-line starting of normal-torque, general-purpose motors.

Call your American Blower branch office for full information, or write American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ont.

AMERICAN BLOWER

Division of AMERICAN-Standard

"Use **wire rope?** Get this helpful **recommendations book!"**



"Roebling Wire Rope Recommendations and Catalog" is designed to simplify the selection and ordering of the right wire rope for specific applications—whatever they may be.

The best wire rope for top performance on any job shows up at a moment's notice . . . making the right choice is easy as flipping the tabbed pages of this easy-to-follow, 56-page book. Besides, there's a simple, foolproof, coded ordering system, which identifies the desired size, grade and construction.

May we send you your copy? Mailing the coupon will bring it to you at once. And should the catalog prompt any question on which you'd like further information, field men from your nearest Roebling office or distributor will, of course, assist you . . . or write Wire Rope Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

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Please send me my copy of "Roebling Wire Rope Recommendations and Catalog."

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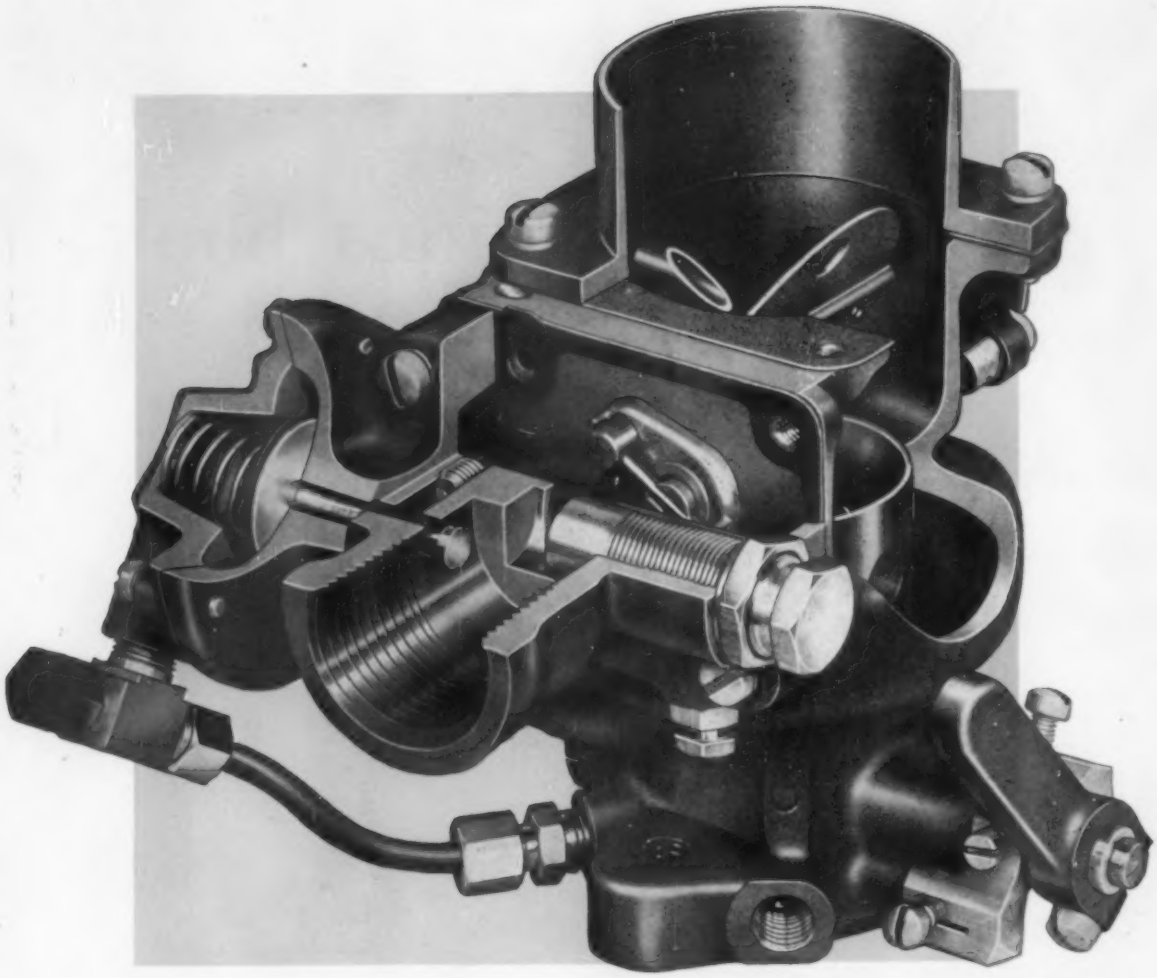


On America's finest gas engines... ENSIGN

Model Xg in Up-Draft position showing air cleaner elbow.

- Built-in fixed orifice economizer.
- Instant starting. Utilizes separate set of adjustable gas-air orifices.
- Provisions for balancing air-fuel ratios against air entrance losses.
- Interchange venturi to meet wide range of engine operating conditions.
- Made in 1¼, 1½, 1¾ and 2" SAE Sizes.

Pictured here is the culmination of 45 years of carburetor experience—ENSIGN'S Model Xg Gas Carburetor for Natural and LP-Gas engines.

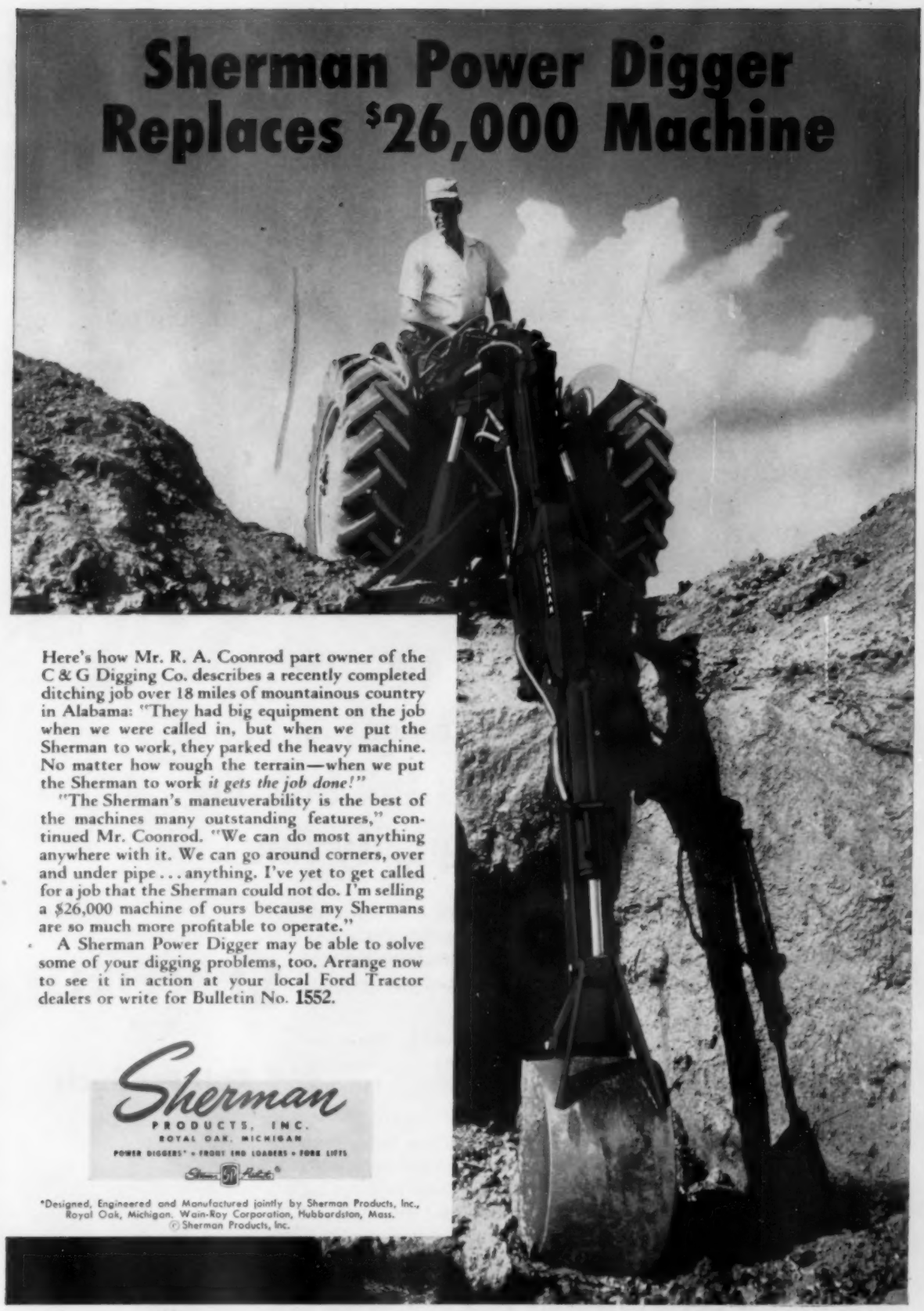
Every part of this carburetor—every contour is carefully designed to achieve certain results, the combination of which spells Easy Starting, Rapid Acceleration, Smooth Idle, Full Power and Economy. But most important, is the ability of this carburetor to perform consistently throughout the entire life of the engine. DEPENDABILITY—that's what the name ENSIGN on a carburetor stands for. Insist on ENSIGN—accept nothing less.

For complete details of all Ensign equipment send for Catalog #108.

ENSIGN CARBURETOR COMPANY

1551 E. Orangethorpe, Fullerton, California
Branch Factory: 2330 W. 58th Street, Chicago, Illinois

Sherman Power Digger Replaces $26,000 Machine



Here's how Mr. R. A. Coonrod part owner of the C & G Digging Co. describes a recently completed ditching job over 18 miles of mountainous country in Alabama: "They had big equipment on the job when we were called in, but when we put the Sherman to work, they parked the heavy machine. No matter how rough the terrain—when we put the Sherman to work *it gets the job done!*"

"The Sherman's maneuverability is the best of the machines many outstanding features," continued Mr. Coonrod. "We can do most anything anywhere with it. We can go around corners, over and under pipe . . . anything. I've yet to get called for a job that the Sherman could not do. I'm selling a $26,000 machine of ours because my Shermans are so much more profitable to operate."

A Sherman Power Digger may be able to solve some of your digging problems, too. Arrange now to see it in action at your local Ford Tractor dealers or write for Bulletin No. 1552.

Sherman
PRODUCTS, INC.
ROYAL OAK, MICHIGAN
POWER DIGGERS* • FRONT END LOADERS • FORK LIFTS

*Designed, Engineered and Manufactured jointly by Sherman Products, Inc., Royal Oak, Michigan. Wain-Roy Corporation, Hubbardston, Mass.
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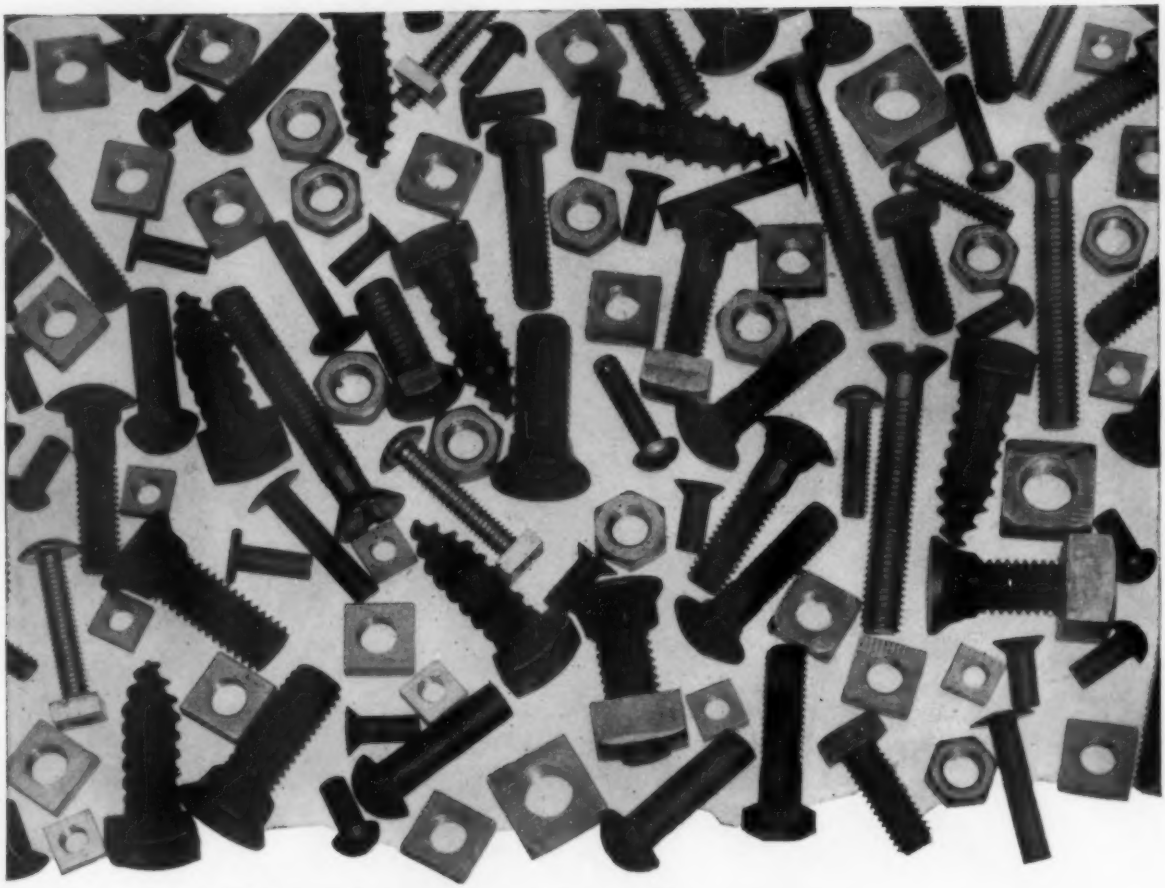

From heads to threads . . .

You'll find Sheffield's full bolt line is a precision-made quality line

Quality-controlled from steelmaking to finished bolt. Sheffield bolts and cap screws give you an unbeatable combination of Sheffield's own special analysis steel and fine manufacturing precision. We're old hands at it—making bolt and nut products since 1888.

Precision-formed: A Sheffield bolt-and-nut assembly, like a precision machine, is made to close tolerances. Holds tight when the pressure's on, and stands up under toughest conditions. Free-running threads save installation time.

You'll get exactly what you want—fast—when you order from Sheffield's FULL line of standard and special bolts and cap screws. Or, if yours is an unusual need, Sheffield has finest facilities for making fasteners to your blueprint specifications. We'll help you select the most economical way to solve any fastening problem. Get in touch with your nearest Sheffield office now.

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SHEFFIELD DIVISION ARMCO STEEL CORPORATION SHEFFIELD PLANTS: HOUSTON • KANSAS CITY • TULSA

CAN YOU USE A SALES FORCE TO SELL YOUR PRODUCT TO THE OIL AND GAS PRODUCING INDUSTRY?

If you manufacture standard or specialty oil country products used in the production of oil and gas, here is a way to increase your sales promptly and without cost.

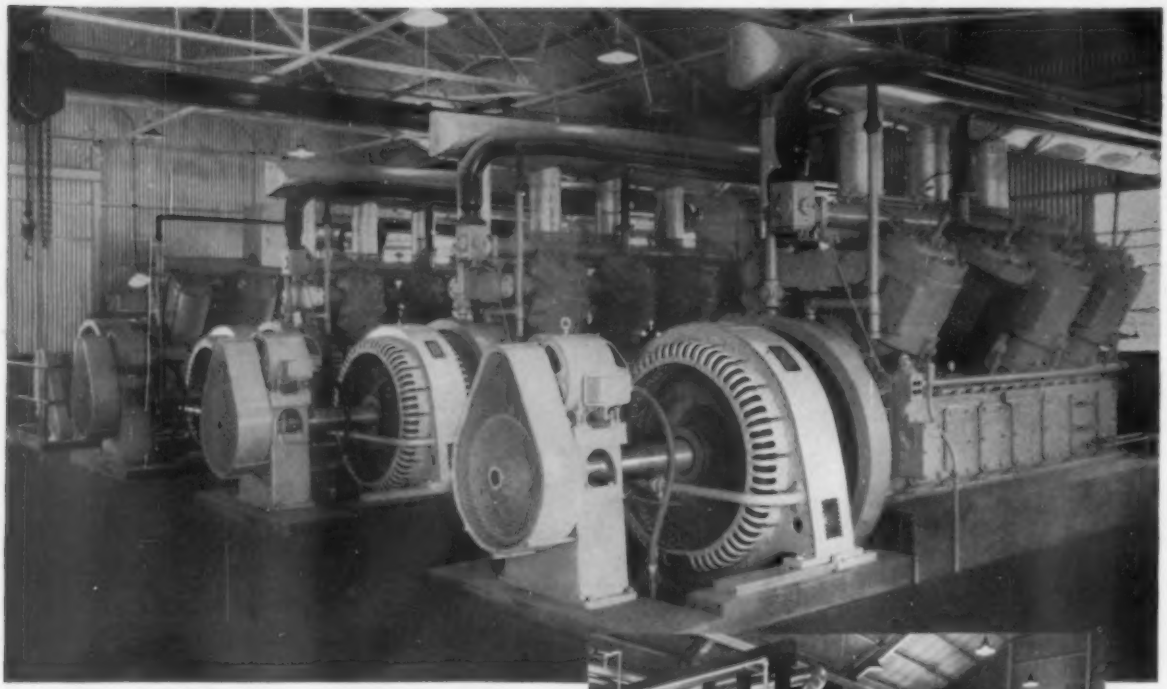
A manufacturer, doing an increasingly successful business in the oil country for over sixty years, is interested in adding several products to the lines its sales force now handles.

By utilizing this established sales force you obtain immediately the benefits of a complete marketing organization, well known and respected in the industry and backed by a highly successful sales record. You receive prompt payment, from one company with AAA rating who would do all its own billing.

Write to us about your needs and include a description of your products. Your letter will be held in strict confidence, given careful consideration, and you will receive a prompt reply. Personal interviews will be arranged.

Write to Box K-124, The Oil and Gas Journal, Tulsa, Oklahoma.

selected for "extras" at no extra cost!



Three Elliott 280-kw gas-engine-driven-generators serve a natural gasoline plant in Texas. Exciters, mounted on outboard bearings, are V-belt driven.

ELLIOTT

FABRI-STEEL generators

extra strength, extra efficiency
extra long life plus less maintenance

For more than 60 years, plant operators throughout the oil industry have benefited by Elliott "extras." There's a simple, logical reason why. The "extras" are designed into Elliott Fabri-Steel Generators in the first place. Crackproof strength of welded steel in frame and spider, electrically welded fabricated steel in stator and rotor, extra bracing of windings, and many other construction features add up to quality performance. Easy accessibility for routine cleaning and maintenance is another Elliott "bonus."

For full details, ask your nearby Elliott District Office for bulletin PB-2000, or write . . .

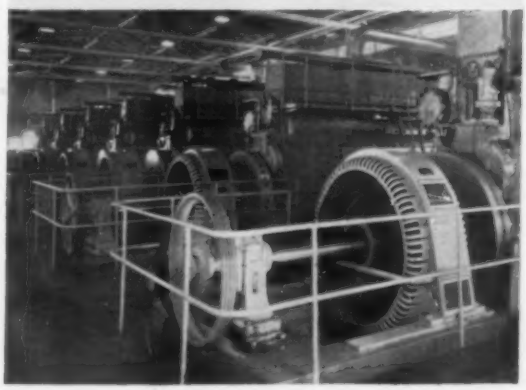
ELLIOTT Company

Ridgway Division • **RIDGWAY, PA.**

R7-8

Here are three Elliott 312-kva generators which serve another gasoline plant in Texas.

Seven Elliott generators, rated 656-kva, serve this recently-built natural gasoline plant.



MUELLER®

high pressure connections

There is no need to shut down those high-pressure oil, gas, water or steam lines to make additional connections. Mueller high-pressure drilling machines and fittings permit high-pressure connections to be made in complete safety, without loss of fluid. Mueller fittings of many types may be welded to lines, pressure vessels or storage tanks, then put in service under pressure with the Mueller DH-2 Drilling Machine – no expensive shutdown or drainage is necessary.

Mueller high-pressure fittings are equipped with an internal valve or completion plug, that can be inserted or extracted with the H-17145 Completion Machine. Completion plug permits removal of drilling machine and gate valve after cut has been made. An external completion cap is then installed over the fitting to provide a double seal.

DH-2 Drilling Machine Drills ¼" through 2¼" – power or hand-operated – automatic or manual tool feed – 14" boring bar travel – working pressures to 1200 p.s.i. at 100°F. – working temperatures to 500°F. at 1000 p.s.i.

H-17145 Completion Machine Inserts and extracts completion plugs or valve stems in Mueller NO-BLO® fittings. Reconditions valve seats in tees and valves.

Write for complete information on these and other Mueller NO-BLO machines and equipment.

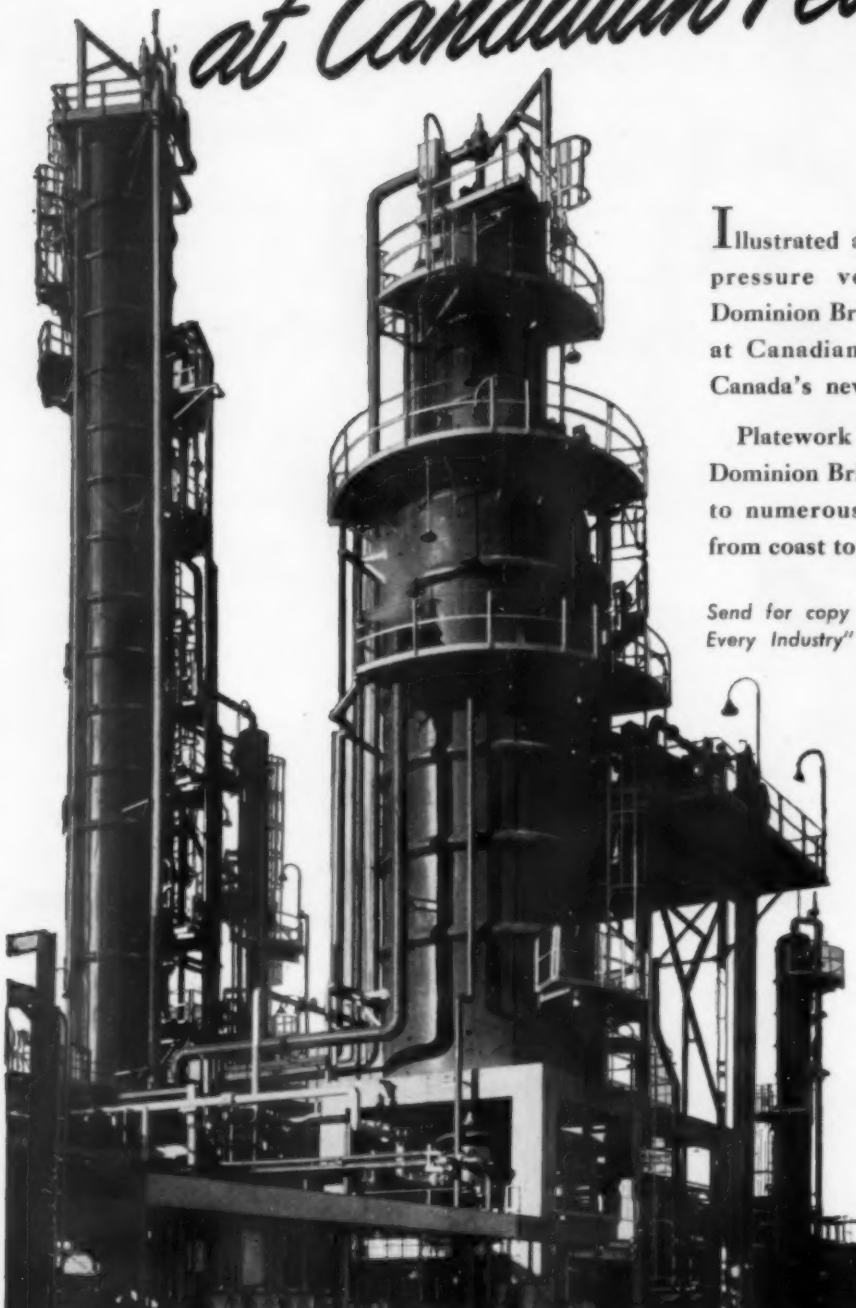
MUELLER CO. **DECATUR, ILL.**

Factories at: Decatur, Chattanooga, Los Angeles; In Canada: Mueller, Limited, Sarnia, Ontario

MUELLER CO. 100th YEAR SERVING the Water and Gas Industries QUALITY

Since 1857

DOMINION BRIDGE
at Canadian Petrofina



Illustrated are two of many large pressure vessels fabricated by Dominion Bridge and now in service at Canadian Petrofina Limited—Canada's newest refinery.

Platework and structural steel by Dominion Bridge have been supplied to numerous Canadian refineries from coast to coast.

Send for copy of booklet "Platework for Every Industry" Publication No. PNN-100

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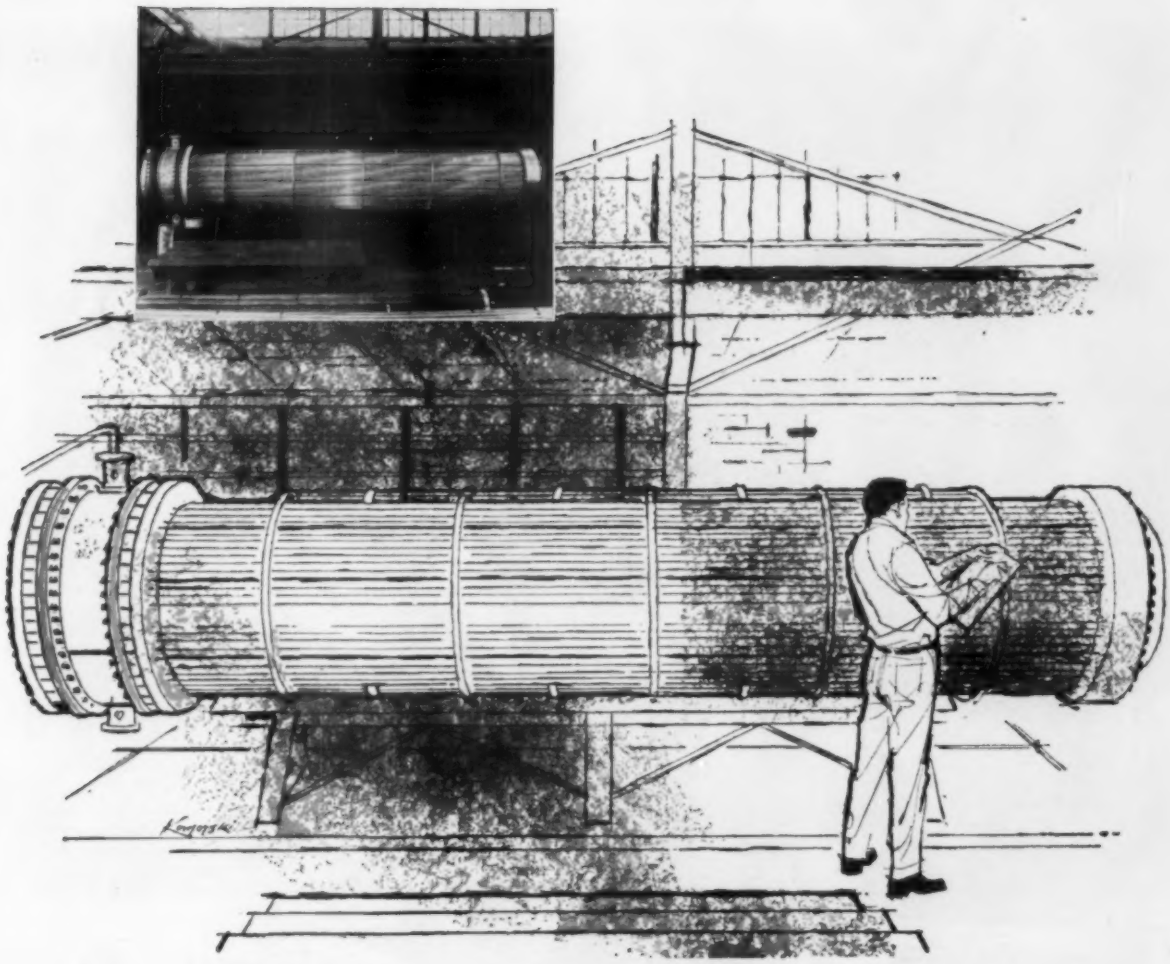
DOMINION BRIDGE COMPANY LIMITED



WESTERN SUPPLY SPECIFIED ALCOA ALUMINUM ALL THE WAY

on these 100% aluminum Dilution Coolers

The exchanger illustrated is one of a number furnished by Western Supply Company, Tulsa, Oklahoma, for a recent low-pressure polyethylene installation. They selected Alcoa® Aluminum for this service because of its protection of product color and stability, good heat transfer properties and corrosion resistance. For the same reasons, aluminum has also found wide use in ammonium nitrate cooling, sour gas treatment and many low temperature processes.

As Western Supply Company sums up the case for Alcoa Aluminum Heat Exchangers: "In our experience Alcoa Aluminum is a sound, low-cost solution to many of the problems encountered in petroleum refining, natural gasoline manufacturing, petrochemical and chemical processing."

If *you* have heat transfer problems affecting tubes or other components of either the channel or shell side, investigate aluminum! Aluminum offers corrosion resistance and good heat transfer properties at minimum cost, and has excellent physical properties at extremely low temperatures. Get details in the FREE BOOKLET, *Alcoa Aluminum Heat Exchanger Tubes.* Mail the coupon today!

THE ALCOA HOUR
TELEVISION'S FINEST LIVE DRAMA
ALTERNATE SUNDAY EVENINGS

ALUMINUM COMPANY OF AMERICA
904-D Alcoa Building, Pittsburgh 19, Pa.

☐ Send me the FREE BOOKLET, Alcoa Aluminum Heat Exchanger Tubes.

☐ My heat exchanger problem is:

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

"The average life of these CONTINENTAL ENGINES has been 400,000 miles"

TALK ABOUT CONVENIENCE! Swing-away front fenders of Brockway's Model 258-W make it easy to get at the engine for adjustment, inspection, or servicing. The five units at left above are powered by Continental R-6572 engine, running on LPG. They bring to 76 the number of Continentals in the Ritter fleet.

TRANSPORTATION GASOLINE ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
N4062	4	2⅛	3½	62	26.3 @ 3500 RPM
Y4069	4	2½	3½	69	28.0 @ 3500 RPM
Y4091	4	2⅞	3½	91	36.0 @ 3400 RPM
F4124	4	3	4⅛	124	47.0 @ 3200 RPM
F4140	4	3 3/16	4⅛	140	52.0 @ 3200 RPM
F4162	4	3 7/16	4⅛	162	58.0 @ 3200 RPM
F6186	6	3	4⅛	186	77.0 @ 3500 RPM
F6209	6	3 3/16	4⅛	209	90.0 @ 3500 RPM
F6226	6	3 5/16	4⅛	226	98.8 @ 3500 RPM
F6244	6	3 7/16	4⅛	244	105.0 @ 3750 RPM
M6271	6	3⅝	4⅛	271	96.5 @ 3000 RPM
M6290	6	3¾	4⅛	290	108.0 @ 3000 RPM
M6330	6	4	4⅛	330	125.0 @ 3000 RPM
M6363	6	4	4 13/16	363	146.0 @ 3000 RPM
B6371	6	4⅛	4⅝	371	123.5 @ 3000 RPM
B6427	6	4 5/16	4⅝	427	142.0 @ 3000 RPM
K6271	6	3⅝	4⅛	271	114.5 @ 3200 RPM
K6290	6	3¾	4⅛	290	123.0 @ 3200 RPM
K6330	6	4	4⅛	330	147.0 @ 3200 RPM
K6363	6	4	4 13/16	363	162.0 @ 3200 RPM
T6371	6	4⅛	4⅝	371	143.8 @ 3000 RPM
T6427	6	4 5/16	4⅝	427	170.0 @ 3000 RPM
U6501	6	4½	5¼	501	178.0 @ 2600 RPM
R6513	6	4½	5⅓	513	192.2 @ 2800 RPM
R6572	6	4⅝	5⅓	572	220.0 @ 2800 RPM
R6602	6	4⅞	5⅓	602	232.0 @ 2800 RPM
S6749	6	5⅛	5½	749	250.0 @ 2800 RPM
S6820	6	5⅜	5½	820	275.0 @ 2800 RPM
V8603	8	4¼	4¼	603	240.0 @ 3200 RPM

TRANSPORTATION DIESEL ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
TD6427	6	4 5/16	4⅓	427	116.0 @ 2400 RPM
RD6572	6	4⅜	5⅓	572	172.0 @ 2400 RPM
VD8603	8	4¼	4½	603	182.0 @ 2800 RPM
SD6802	6	5 1/16	5½	802	225.0 @ 2200 RPM

EXCERPT FROM A LETTER FROM THE H. R. RITTER TRUCKING CO., PARAMUS, N. J., TRANSPORTERS OF PETROLEUM PRODUCTS:

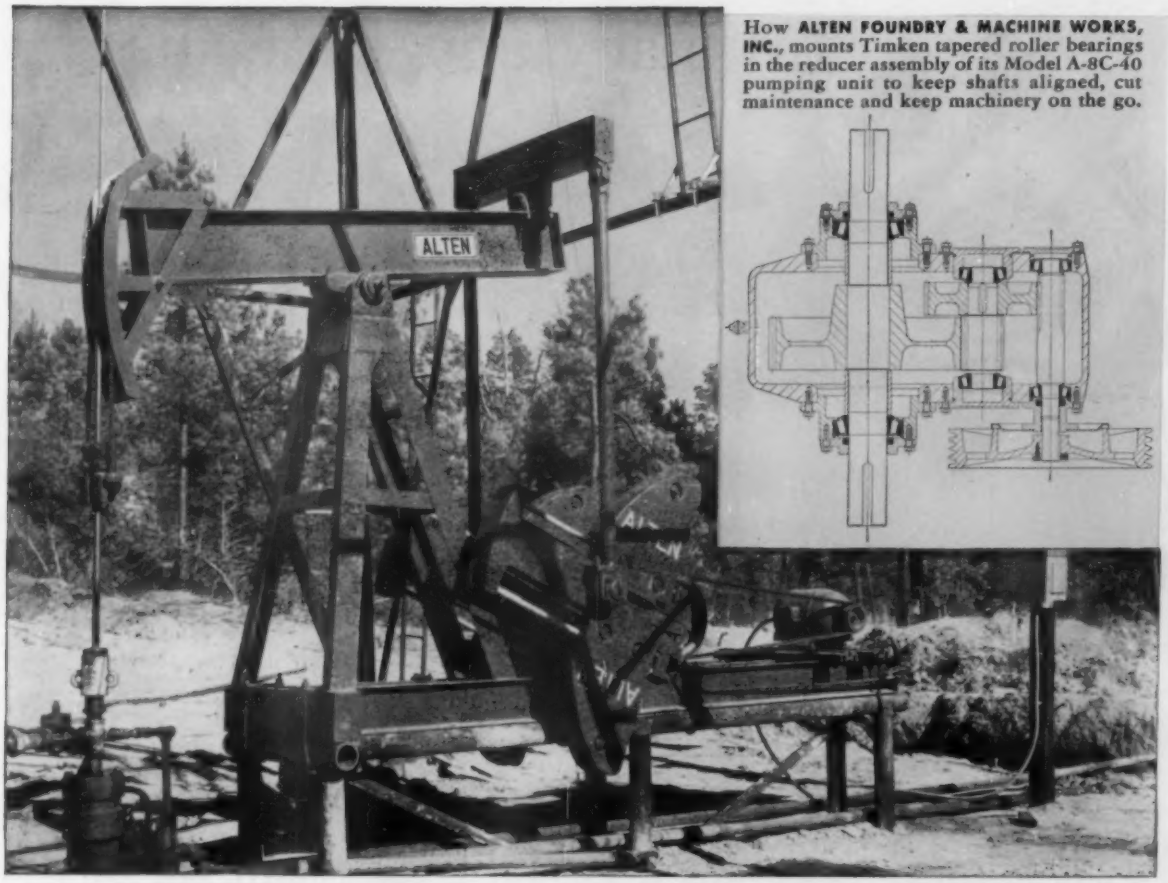
"Sixty per cent of our fleet is powered with Continental motors. We covered 2,433,600 miles last year and delivered 100,865,200 gallons of product, or approximately 322,000 tons, over level and mountainous terrain. The average life of these Continental motors has been 400,000 miles, with re-building costs approximately $391 per 100,000 miles. Since using our first Continental, in 1946, we have replaced only one crankshaft. In all the units we have re-built, we have never ground a shaft. All in all, the fine performance given us by Continental motors has greatly contributed to our success as an over-the-road operator."

(Signed) "C. W. Rosencrans
Vice president."

CONTINENTAL MOTORS — Powerful as the Nation — AMERICA'S STANDARD

Continental Motors Corporation

MUSKEGON • MICHIGAN



How **ALTEN FOUNDRY & MACHINE WORKS, INC.**, mounts Timken tapered roller bearings in the reducer assembly of its Model A-8C-40 pumping unit to keep shafts aligned, cut maintenance and keep machinery on the go.

Oil pumping unit is 'all pump—no slump' with shafts on TIMKEN® bearings

ALTEN Foundry & Machine builds pumping units like this model A-8C-40 for the rugged service of the petroleum industry. Because every part is engineered to give uninterrupted field operation, Alten units perform to full-rated capacity day in, day out—pumping oil from deep wells. With the slow speed shaft, intermediate shaft and high speed shaft of the reducer assembly mounted on 6 Timken® bearings, the pump keeps on the go with maximum efficiency. Costly shutdowns are prevented.

Tapered construction lets Timken bearings take radial and thrust loads in all combinations. You get extra load-carrying capacity—with full line contact between rollers and races. By keeping shafts concentric with housings, Timken bearings make closures more effective in keeping lubricant in, dirt, dust out. Timken bearings practically eliminate friction, which reduces wear on related parts, prolongs life. They're geometrically designed to give *true rolling motion*, precision-manufactured to do just that in actual daily service. We even make our own steel, which no other American bearing maker does.

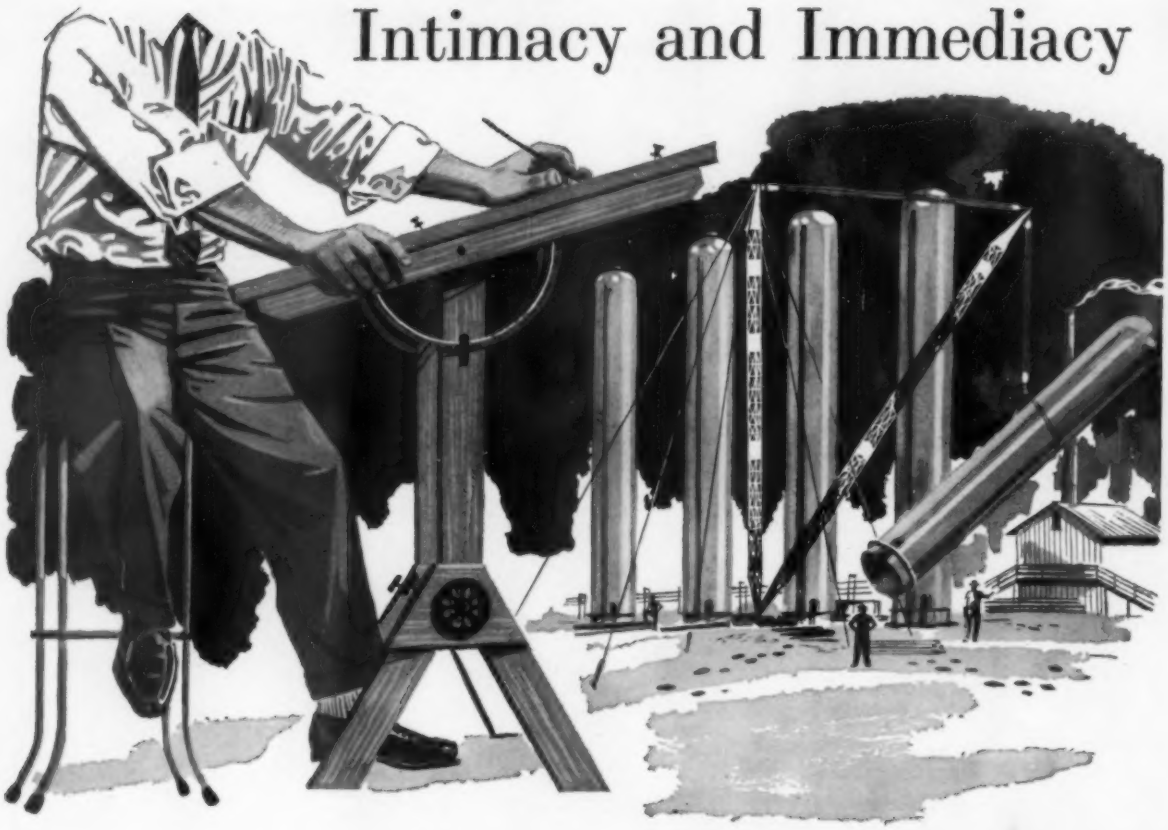
Insist on the precision and high quality of Timken bearings, as Alten has done for many years. When you build or buy machinery for the petroleum industry, look for the trade-mark "TIMKEN" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN · TAPERED ROLLER BEARINGS ROLL THE LOAD

TRADE-MARK REG. U. S. PAT. OFF.

Intimacy and Immediacy



YOU GET BOTH IN A PRITCHARD SINGLE RESPONSIBILITY CONTRACT

Two prerequisites to a successful construction project—whether it be for a new plant, modernization or expansion of present petroleum and gas facilities—are an intimate knowledge of the project, and the ability to hasten its completion.

With a Pritchard Single Responsibility Contract you are working with only one firm. Complete responsibility for everything is solely with Pritchard. Since no other prime contractors are involved, Pritchard is intimately familiar with what is going on and can accurately report progress to you. Designers work closely with engineers; engineers coordinate drawings with actual construction, and purchasing is done on a precise time schedule.

How about immediacy? From the moment you sign your Pritchard Single Responsibility Contract there is a steady flow of activity. No time is lost. Preliminary construction begins even before final engineering drawings are completed. Materials arrive on the job site to coincide with strict timetables. The result? Your project is completed faster, your new plant is in operation producing income sooner and you can free invested capital faster for other uses.

Before you go any further with your new plant or plant expansion, investigate all the advantages that are yours with a Pritchard Single Responsibility Contract.

YOUR INQUIRY IS INVITED

SERVING THE GAS, PETROLEUM, CHEMICAL, PETROCHEMICAL, PULP, AND PAPER INDUSTRIES AND THE POWER PLANT NEEDS OF INDUSTRY AND CORPORATE UTILITIES.

INDUSTRY'S PARTNER

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KANSAS CITY 12, MISSOURI
MANUFACTURERS
OF COOLING TOWERS AND GAS AND
AIR TREATING EQUIPMENT

VALVES

to control anything but rain!

My Boss buys a lot of valves — or has it done — and he sure likes to buy them from J&L Supply.

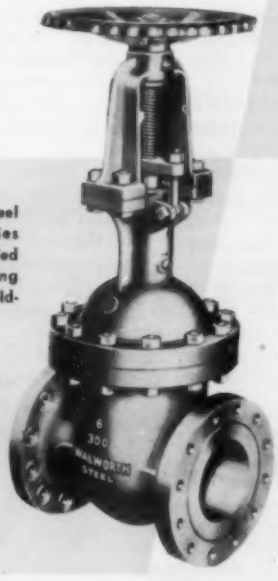
"Give those people the facts," says he, glancing at my new raincoat, "and they'll come up with the perfect valve for handling anything but rain."

"And what do we mean by the 'facts'?", says I, eager to be a good secretary.

"Oh," says he tolerantly, "to get the perfect valve for exacting jobs, we just give J&L complete service information: size and flange rating and facing, fluid to be handled, operating pressure, maximum temperature, any special corrosive conditions — that sort of thing."

"Oh?" says I.

"Young lady," says he, sensing my confusion, "don't expect to learn all about valves in a day. J&L Supply usually recommends Walworth, and Walworth was making and improving valves before your great granddaddy was born!"



Walworth Cast Steel Gate Valve, Series 300. Can be supplied with Roller Bearing Yoke and Butt Welding End.

29-G

Jones & Laughlin

SUPPLY DIVISION – Tulsa

SERVING THE UNITED STATES AND CANADA

an ACCO product

American Cable TRU-LAY VHS | 15% STRONGER

This Reel Means Safer, Faster Drilling

You're seeing this reel, with its proud VHS label, at more and more rigs in every section of the oil country. For drillers are learning that new VHS rotary lines, made from a new grade of steel for Wire Rope, possesses important advantages.

To begin, VHS is at least 15% stronger than Improved Plow Steel—the best grade available, before VHS.

Higher Safety Factor

This additional strength means a higher safety factor. For example the safety factor for 10 lines of VHS is about equal to the factor of safety for 12 lines of IPS. Or, the factor of safety for 10 lines of VHS is 14.9% or 15% higher than for 10 lines of IPS.

Drill Faster—Cut Down Time

With stronger VHS you can drill deeper before increasing the number of parts of line. You can make round trips faster. And VHS's extra strength eliminates, in many cases, any necessity for regrooving sheaves or buying new blocks to use larger diameter lines for higher safety factors.

Tougher, Too!

VHS is not only stronger, it's tougher. And this combination of extra strength and toughness gives it higher resistance to abrasion and greater resistance to peening . . . both important factors in maintaining rope diameter and shape. If regular adaptable cut off practices are followed, ton mile advantages should result.

Easy to Order

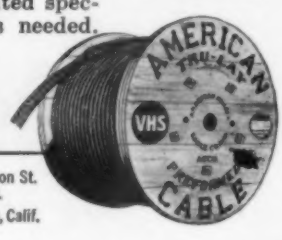
To order VHS drilling line just call your nearest Mid Continent Supply Store and tell them the length and diameter you want. No complicated specifications needed.

For further information write to the nearest American Chain & Cable Company office listed at right for
Brochure DH-516H

ACCO

American Cable Division
AMERICAN CHAIN & CABLE

630 McFarland St. | Houston 1, Texas
4555 E. 46th Ave. | Denver 16, Colorado
2216 S. Garfield Ave. | Los Angeles 22, Calif.
400 W. Madison St. | Chicago 6, Ill.
Wilkes-Barre, Pa.; Odessa, Texas; New York, N.Y.; Philadelphia, Pa.; San Francisco, Calif.



Keep areas weed-free . . . avoid fire hazards

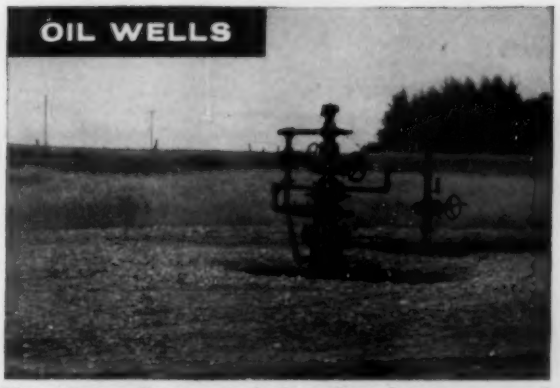
Spray Du Pont TELVAR® WEED KILLERS just once for season-long weed control

You can eliminate weeds and grasses that create fire hazards and that make maintenance difficult and costly. Just one spray of Du Pont "Telvar" controls weeds for a season or longer. "Telvar" kills weeds through the roots, then remains in the soil to provide residual action long after the initial spray is applied. Low dosages save you cost, handling and storage space. "Telvar" weed killers are non-corrosive to equipment, non-volatile, low in toxicity to humans and animals. For low-cost, long-term control of weeds, include "Telvar" in your maintenance program.

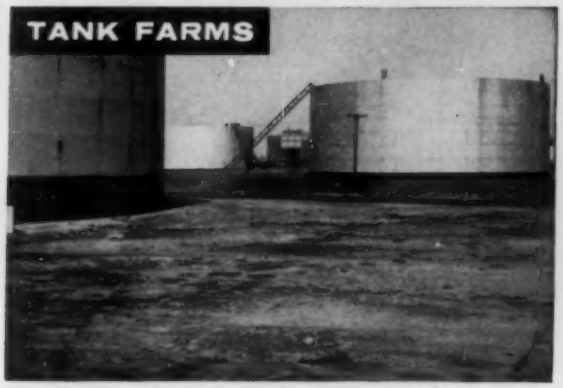
TELVAR®
Monuron and Diuron
WEED KILLERS

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY



Note the excellent control of weeds and grasses around this wellhead from just one application of "Telvar."

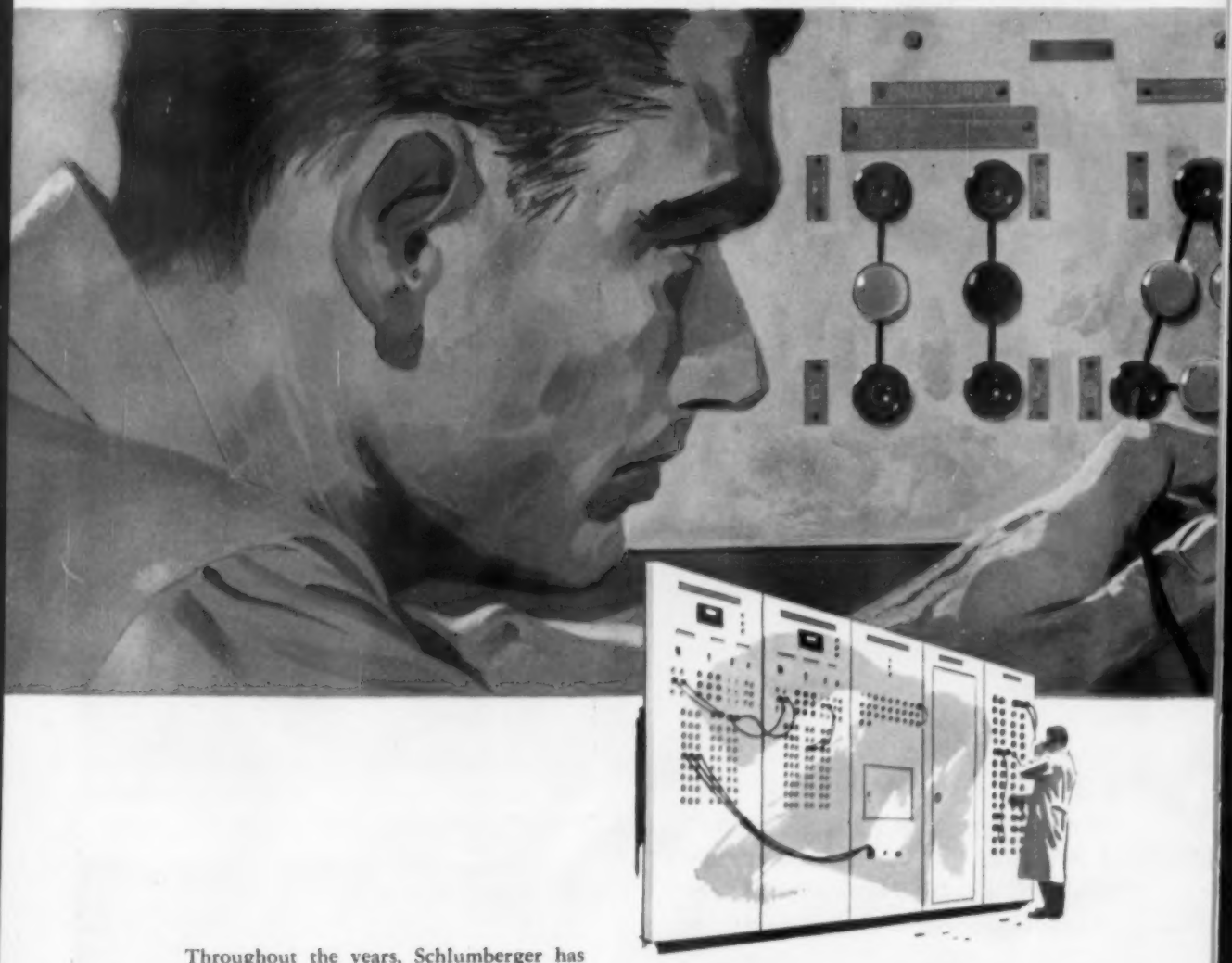


The treated area around this tank farm has remained weed-free for an entire season.

Along these pipelines, where maintenance is tough, one application of "Telvar" has kept the treated area weed-free for a year.

On all chemicals, follow label instructions and warnings carefully.

Logging Through A Switchboard!



Throughout the years, Schlumberger has maintained leadership in the development of better oil-finding tools.

Recent notable developments include—

The Combination-Induction Electrical Log

The Formation Tester

The Capsule-Jet

These services . . . which are helping you find oil today . . . were the switchboard experiments of yesterday.

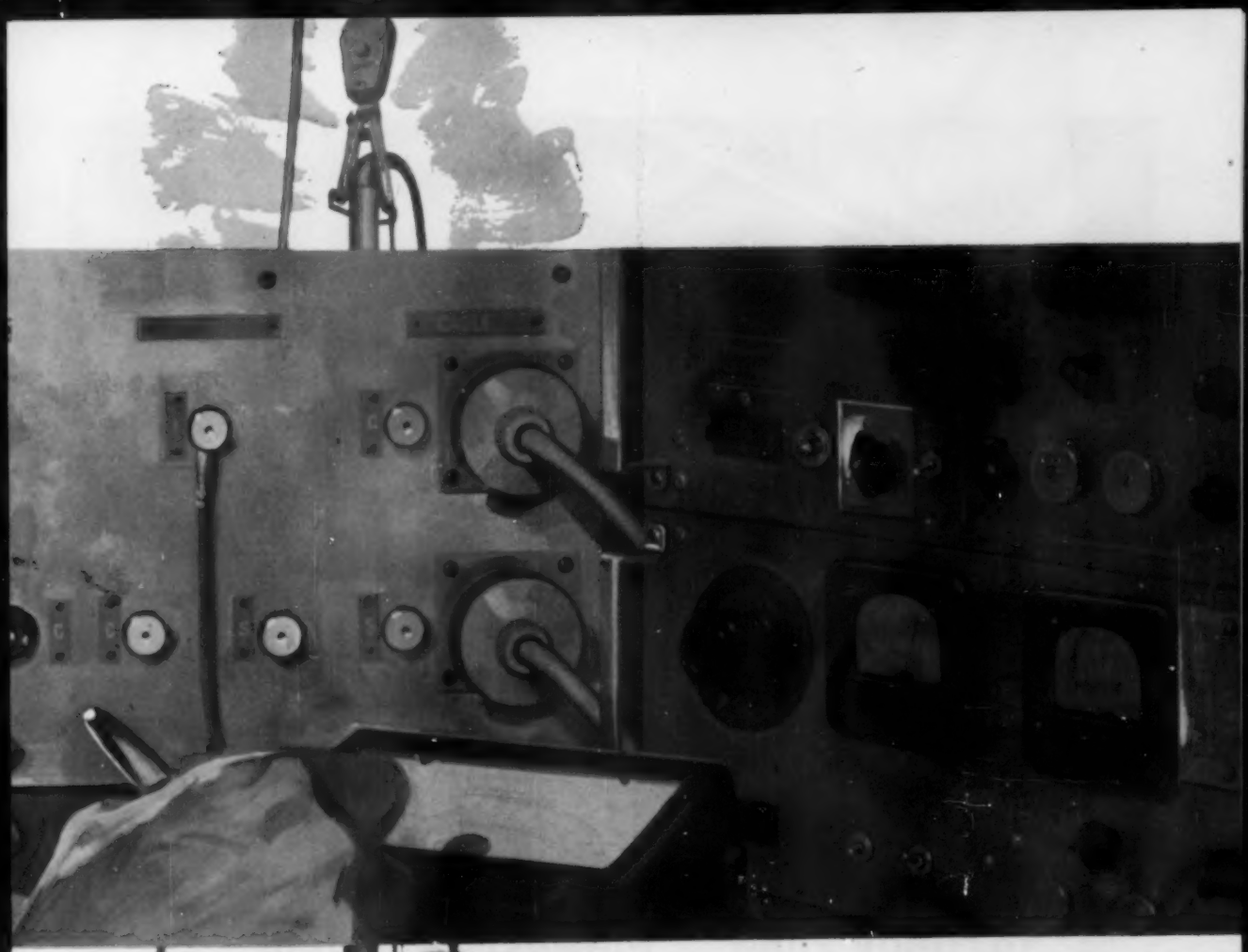
You cannot lower an idea into a well—it's a long way from original ideas for improved logging methods to practical field applications.

The carrying out of a concept means the design of an instrument that will withstand the shocks, pressures, and temperatures encountered in a bore hole . . . and still deliver precise information.

To aid in this work, engineers at the Schlumberger plant in Houston conduct simulated field tests from their laboratory benches. Each laboratory is wired to a common test well with standard logging cable. A "flick of the switch" in a distribution center connects the logging instrument in the well with the surface recording equipment in the laboratory. This "logging through a switchboard" illustrates the progressive engineering practices utilized at Schlumberger.

SCHLUMBERGER

Well Surveying Corporation



SCHLUMBERGER . . . Engineering for Better Service

To keep supports sturdy where maintenance is most difficult, Monel sheathing was applied to this tender type drilling platform during construction by Brown & Root, Inc., Houston, Texas. It is typical of many such structures built by this company.

In tidal zone...hardest to shield... Monel sheathing gives lasting protection against corrosion

Fast becoming standard on offshore structures

THIS drilling platform shows a practice now rapidly becoming universal among large oil companies.

Monel* nickel-copper alloy sheet tightly wrapped about supporting members to protect them from corrosion in the "tidal and splash zone."

Adoption of the nickel-copper alloy sheathing is based upon its actual, on-the-job performance. And in comparison with that of other materials . . . in the hard-to-shield splash zone where water, air and spray attacks fluctuate, leaving piling sometimes wet, sometimes dry.

Monel nickel-copper alloy resists corrosion by salt water, salt air and salt spray. It withstands wave battering and erosive action as well as abuse from floating debris. And it is easily applied by welding.

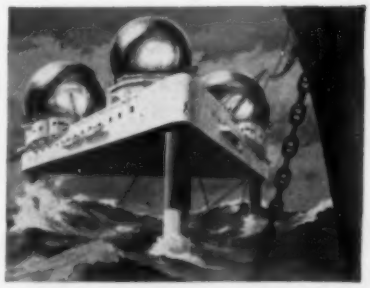
Usually, 8 to 12 feet of each vertical support is completely sheathed with 18-gauge Monel alloy sheet. With tops, bottoms and seams welded, it protects supports in the critical zone . . . mean tide level to a few feet above prevailing wave crests. Protects diagonal braces and conductor pipe sleeves where necessary, too.

With Monel alloy sheathing, many oil companies extend life of drilling and tank battery barges, well head protector platforms and loading docks.

This nickel-copper alloy sheathing may help prolong life of *your* new structures or those now in water. If you need help with your problem, write to International Nickel.

*Registered Trademark

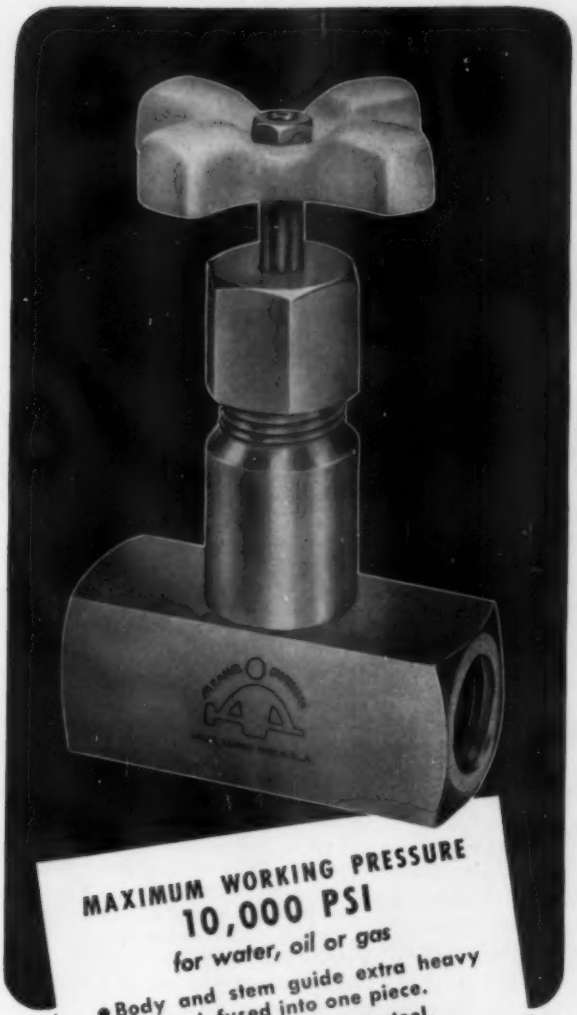
The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.



100 miles out in the Atlantic, Monel keeps "sea legs" sturdy under the Navy's man-made islands.

INCO TRADE MARK **Nickel Alloys**

Monel... *for minimum maintenance*

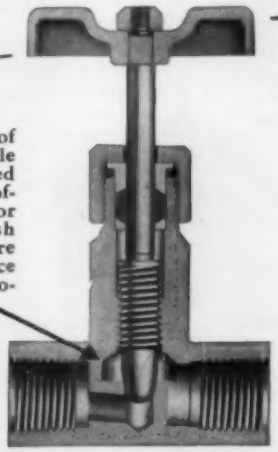


MAXIMUM WORKING PRESSURE
10,000 PSI
for water, oil or gas

- Body and stem guide extra heavy bar stock fused into one piece.
- Valve stem 416 stainless steel.
- Packing special one-piece "Marpak" moulded ring.
- Bodies marked in accordance with MSS regulations.

ONE PIECE

The stem guides of conventional needle valves are screwed into bodies—this often causes leakage or blow-outs. Marsh Needle Valves are fused into one-piece by exclusive "Conoweld" process.



The Ultimate in Needle Valves

Here is one of the crowning achievements of Marsh research, design, and manufacturing skill. It is the first needle throttling and shutoff valve to combine *all* of the qualities called for today in this highly critical and ever broadening field.

It is a valve that has strength and safety to spare . . . rated for pressures up to 10,000 psi—equally efficient in the lower ranges. A product of Marsh instrument-making and valve manufacturing experience, it combines instrument-like precision with the ruggedness that distinguishes all Marsh valve specialties.

The illustrations tell the story of new thinking; new standards. Body and stem-guide are machined from extra-heavy carbon steel bar stock. Still greater strength and rigidity are achieved by fusing the stem-guide into the body. The complete fusion of guide and body is accomplished by the exclusive Marsh "Conoweld" process.

There are two big advantages to this one-piece construction: (1) It eliminates the danger of unscrewing the valve from the body when opening—a frequent cause of leakage, even dangerous blow-outs (2) It permits perfect line-up of threads and seat. As a result, Marsh valves are easier to operate even at high pressures.

The precision-machined stem is 416 stainless steel. Stem threads are fine pitch for extra strength and fine, controlled regulation. Notable advancements are special "Marpak" one-piece, non-binding longer-lasting packing; deep thread chambers, keeping inlet and outlet piping away from ports and contributing excellent flow characteristics. Entire packing nut and packing gland are electro-zinc plated, preventing corrosion and giving the valve a handsome, plated exterior. The rugged malleable handle is finished in heavy baked enamel.

The new needle valve line includes globe and angle patterns with double female connections in sizes ⅛", ¼", ⅜", ½", ¾" and 1". Also globe and angle valves with male inlet and female outlet in sizes ¼" and ½". *Complete stock carried at our Skokie, Illinois factory and also at our branch plant in Houston, Texas.*

Write today for catalog giving complete details.

MARSH INSTRUMENT CO. *Sales Affiliate of Jas. P. Marsh Corporation*
Dept. L, Skokie, Ill. • Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd St., Edmonton, Alberta • Houston Branch Plant: 1121 Rothwell St., Sect. 15, Houston, Texas

MARSH

"THE STANDARD OF ACCURACY"

WILL HANDLE THEM ALL!

Wedge and sealing rings molded from DuPont Teflon assure efficient, safe handling of all known industrial chemicals and corrosives at temperatures varying from −120°F. to +500°F. Spring and metal parts are furnished in the metallurgical specification best suited to the particular service. In every way, you get a mechanical seal that is "John Crane" engineered to your requirements—no matter how tough!

The Type 9 Seal has and continues to solve innumerable problems where difficult-to-handle liquids and gases are involved . . . at pressures up to 750 psi. It can do the same for you.

Use the Type 9 Seal on all rotating shaft equipment—centrifugal and rotary pumps, mixers, agitators, autoclaves, other equipment.

REMEMBER: *Your toughest problem can be the Type 9's next success story.* Send for full details today.

Crane Packing Co., 6419 Oakton St., Morton Grove, Ill., (Chicago Suburb).
In Canada: Crane Packing Co., Ltd., Hamilton, Ont.

JOHN CRANE **CRANE PACKING COMPANY** 38 YEARS INDUSTRIAL PROGRESS

They Say—

Import debate too warm?

Dear Sir:

. . . The question of foreign oil imports affects all operators, but there is a conflict of interest between the importers and the strictly domestic producers. Some nonimporters have become so heated in their discussions that they are in danger of allowing this one problem to overshadow the wide range of activities in which there is a need for amicable and cooperative effort.

Roland Rodman, of Anderson-Prichard Oil Corp., seems to have reached this point in his address before the annual meeting of the North Texas Oil and Gas Association as reported in the April 8 issue (page 71) of The Oil and Gas Journal.

Mr. Rodman referred to the oil importers as "guilty parties" and says they are "getting away with" applying the depletion provision to foreign production. The production and exhaustion of deposits of natural resources is depletion, whether this occurs in the U. S. or foreign countries . . .

The fact that importing companies charge off the taxes they pay to foreign governments against their U. S. tax liability is characterized by Mr. Rodman as another "unethical means of reaping huge profits," and as "dodging U. S. income taxes by taking advantage of a loophole in the law." Does he hold the importers responsible for what he regards as inequities in the tax laws? If his company were so fortunate as to own foreign production, would he insist on paying more taxes than the law specified? . . .

The proposal to limit imports for the protection of the domestic industry is an entirely different question and one which merits attention of both the industry and Government. If such limitations are imposed it should be in a manner to accomplish that specific purpose, such as quotas or tariffs, and should not be undertaken as a campaign to wreck the foreign producing activities of importing companies, or compel them to subsidize the United States shipping industry . . .

Mr. Rodman's speech appears to be an appeal to the emotions and selfish interests . . . and one which is unworthy of the head of a respected independent. We have enough enemies seeking to divide and conquer the oil industry and to impose governmental controls upon it without men in responsible positions in the industry fur-

PROGRESS THROUGH CHEMISTRY

Davison...leader in Silica Gel

Davison pioneered in the development of the first commercially useful silica gel more than three decades ago, and for years has been America's leading producer. Silica gel, with its porous amorphous physical structure providing a surface area of 90,000 square feet per cubic inch, is a unique compound of continuing importance and increasing application. Silica gel's most important properties are its ability to condense and retain condensable gases in the porous structure and its regenerable nature through the application of heat or other elutriation methods. A wide variety of particle sizes, densities and adsorptive capacities are available, each having been developed to meet specific application demands. Investigate Davison Silica Gel, now.

See your Davison Field Service Engineer or write for technical literature.

DAVISON CHEMICAL COMPANY

Division of W. R. Grace & Co.

Baltimore 3, Maryland

Sales Offices: Baltimore, Md.; Chicago, Ill.; Columbus, Ohio; Houston, Texas; New York, N. Y.

Producers of: Catalysts, Inorganic Acids, Superphosphates, Triple Superphosphates, Phosphate Rock, Silica Gels, Silicofluorides: Sole producers of DAVCO® Granulated Fertilizer.

ask for . . .

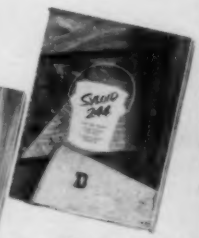
Davison Silica Gel for the dehydration of air and gas.

Syloid® 308 . . . lacquer flatting agent.

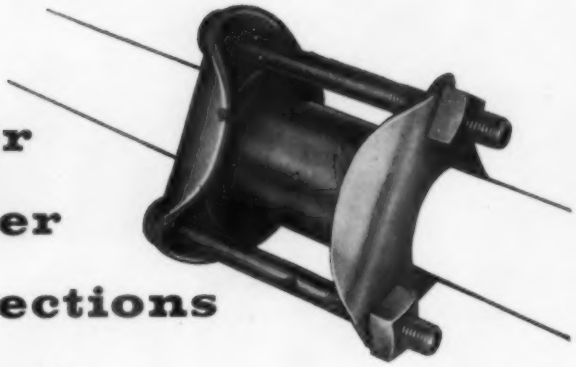
Syloid® AL-1 . . . prevents gas build-up in metallic paint.

Protek-Sorb® 121 . . . for Method II dehydrated packaging.

Syloid® 162 . . . alkyd-urea varnish flatting agent.



Syloid® 244 . . . superior flatting agent in clear alkyd finishes and oleoresinous varnish.



for tighter connections join pipe

THE DRESSER WAY!

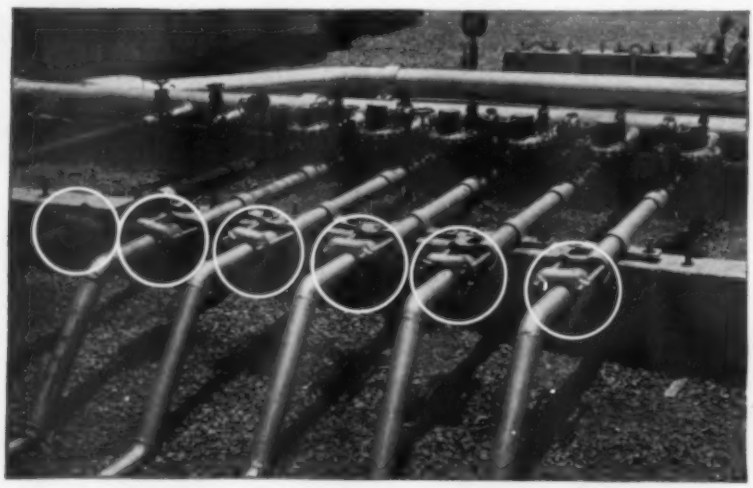
Pictured below are Dresser Style 38 Couplings on the meter manifold of a large oil company's water flood project. These couplings are equally useful in oil piping applications both in and around refineries.

Whatever the application, Dresser Style 38's are fast and easy to install. No pipe threading is necessary. The only tool required is a wrench. And, because of the specially compounded rubber gaskets —which permit up to 4° deflection at joints—offset pipe ends can be coupled making a permanent bottle-tight connection, every time.

DRESSER®

Dresser Manufacturing Division • Bradford, Pa.

ONE OF THE DRESSER INDUSTRIES



AVAILABLE AT ALL LEADING OILFIELD SUPPLY STORES IN THE UNITED STATES AND CANADA

Style 38 Coupling

Style 40 Long Sleeve

Hydrepair® Asbestos Cement Pipe Clamp

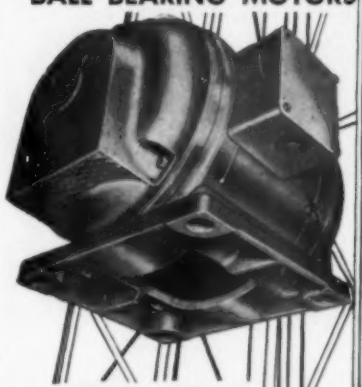
Style 63 Expansion Joint

Style 39 Insulating Coupling

DESIGNED FOR ... TESTED AND PROVEN IN THE OIL FIELDS

FIELDMASTER

BALL BEARING MOTORS



- VERMIN PROOF
- DRIP PROOF
- CORROSION RESISTANT
- MOISTURE PROOF
- FORCED AIR COOLED

Yes... all these features are combined in Fieldmaster Ball Bearing Motors to make them the leading power units in the oil country. Naturally there's a type and H.P. especially suited to fit your specific requirements.

Contact us for complete information on any motor requirement.

BETHLEHEM SUPPLY COMPANY

TULSA, OKLAHOMA

Manufactured by

VALLEY ELECTRIC CORP.

ST. LOUIS 8, MISSOURI

nishing them ammunition and encouragement . . .

Giles A. Penick, Jr.
Attorney
Tulsa.

New processing frontier

"We are now pioneering in a new petroleum frontier, one which may add a new dimension to the processing of crude oil and one which will give us more basic information about the nature of petroleum products.

"There are now three basic tools used in processing crude—heat, pressure, and catalysts. These are used in varying combinations. Now we have a fourth tool—nuclear radiation. . . . We will try to find out how this new tool can be used effectively and economically. The field of possibilities is wide open, and Sinclair scientists approach it with a feeling of great challenge."

P. C. Spencer, president, Sinclair Oil Corp., in a speech at the dedication of Sinclair's Harvey, Ill., radiation and tracer laboratory.

Oil in the "liberal press"

"Those who continue to doubt the intellectual and moral bankruptcy of representative members of the liberal press should have a look at the treatment of the depletion tax issue . . . It (the treatment) is, beginning to end, demagogy — naked, hypocritical, irresponsible.

"Not one of the accounts we have seen of the Senate hearing explored a single relevant question—whether the depletion allowance realistically reflects the distinctive hazards of the oil and gas exploration business; whether the rate of return on the dollar invested in the petroleum business is higher or lower than returns per dollar in other businesses; whether the incidence of dry holes has increased or decreased since (under Roosevelt) the 27½ figure was set; whether other industries receive special tax treatment due to special circumstances, e.g., the exaggerated depreciation rate on commercial airliners; or whether the interests of the national security require, as in uranium, a more aggressive search for oil than would ensue upon the imposition on the industry of the regular corporation tax.

"We are not defending the present depletion rate. It may be too high. It may be too low. It may be just about right. We are saying only that the issue is not illuminated by the kind of attention given to it by the ideologues of the Left, who have easy access to the figures on the basis of which a serious discussion of the depletion rate

Four Times Longer Life*

from Ampco Polished Rod Liners

...with fewer shut-downs for repairs, less loss of production, lower maintenance costs.

You can retard mechanical wear, corrosion and erosion with Ampco polished rod liners.* Even in many of the toughest oil-well services, you can get four times longer life with these remarkable wear-resistant liners—made from Ampco Metal.

Find out today how much money you are spending for sliding wear and corrosion. Check on the "hidden costs" of ordinary liners. Then see how many dollars you can save with Ampco polished rod liners. For more information, just write us.

*Name of this user upon request.

AMPCO® The Metal Without an Equal

AMPCO METAL, INC.
Dept. OG-4 • MILWAUKEE 46, WISCONSIN
West Coast Plant• Burbank, California

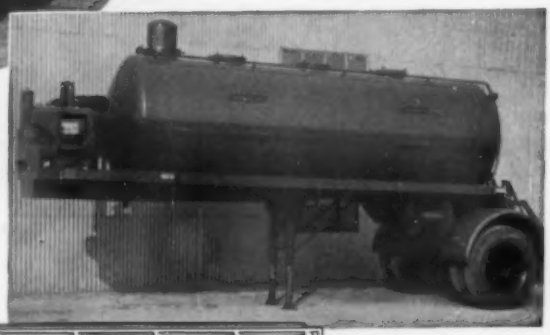
PR-22

MOVING DRILLING MUD *FAST!*

Just for the record, this moving job during a changeover was timed, and here are the results: Exactly 8 minutes, 33 seconds after the driver yanked up on the emergency brake, 45 bbls. of 12 lb. mud was snugly inside the Thompson Unitized Vacuum Tank!

TO THE NEXT HOLE

From there to the next hole was discounted as driving time. Starting the stop watch again when the driver had backed up to the shaker pit, the one man laid hose, opened the valve and had the tank empty in 4 minutes 10 seconds.



This new Vacuum Tank Trailer, complete with engine and pump, is now available. Write for specifications and price!

GET ALL THE FACTS

There's a Thompson Unitized Vacuum Tank built to do your jobs fast, too! Cleaning tanks, draining sumps, pumping out cellars, agitating mud, spraying roads, weeds, etc., are everyday chores for this workhorse. Check UVTs: 20-100 bbls. capacity; truck, trailer, semi-trailer or skid mounted.

THOMPSON
TANK and MANUFACTURING CO. Inc.
2019 EAST WARDLOW RD. LONG BEACH 7, CALIFORNIA

SOLE LICENSEE TO MANUFACTURE VACUUM TANKS UNDER U.S. PATENT NO. 2522077

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621 EAST FOURTH STREET
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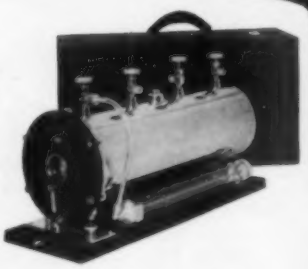
AC-ME SPECIFIC GRAVITY BALANCE

Adopted by the Natural Gasoline Association as the means for determining the specific gravity of natural gas

Designed and constructed to meet the specifications required for determining the specific gravity of gas under the various conditions found in both field and laboratory.

Complete line of accessories available.



AC-ME
RECORDING GRAVITOMETER
FOR ACCURATE GAS MEASUREMENT

- ★ SENSITIVE
- ★ CONTINUOUS RECORD
- ★ AUTOMATICALLY COMPENSATED

This instrument has been designed for accuracy in determining specific gravity of gas—it contains no rotating parts that will wear out and operates on the principle of weighing a volume of gas in comparison with an equal volume of air.

could be conducted. The fact is, they do not want a serious discussion of it."

"Self Portrait in Oil," from the National Review, April 13, 1957.

Oil outlook uncertain

"Rising costs, affecting both capital spending and current operating expense, present the most serious problem facing business today.

"The core of this problem is the constant threat that wages will outrun productivity and, hence, create irresistible inflationary pressures. Rising real wages are essential to continuing prosperity but the rise cannot be real unless it stems from a rise in productivity. Management and labor have a joint responsibility to recognize this fact as the basis for wage policy.

"With regard to the outlook for 1957, we anticipate that demand for our products will average 4 to 5 per cent higher than in 1956. Ordinarily we would expect such an increase to result in a moderate gain in profits. While management seeks this result, it cannot be assumed with any degree of assurance because the oil industry faces more than the usual number of uncertainties.

"The most obvious is the situation connected with the closing of the Suez Canal. The magnitude of this problem and the tremendous burden it places on the American oil industry are well known.

"Another major uncertainty lies in the area of prices. The general increase in crude-oil prices which occurred in January was the result of a cumulative pressure of rising costs which had been building up for almost 4 years. This price increase amounted on the average to about 12 per cent and was the first since 1953. In those 4 years the cost of finding oil had risen by almost 50 per cent."

Henderson Supplee, Jr., president, Atlantic Refining Co., in a statement in the Atlantic Magazine.

CALENDAR

MAY

1-3 American Petroleum Institute, Division of Production, eastern district meeting, William Penn Hotel, Pittsburgh.

4 Association of Oilwell Servicing Contractors, semiannual meeting, board of directors, Baker Hotel, Dallas.

6-8 American Petroleum Institute, annual pipeline conference, Cleveland Hotel, Cleveland.

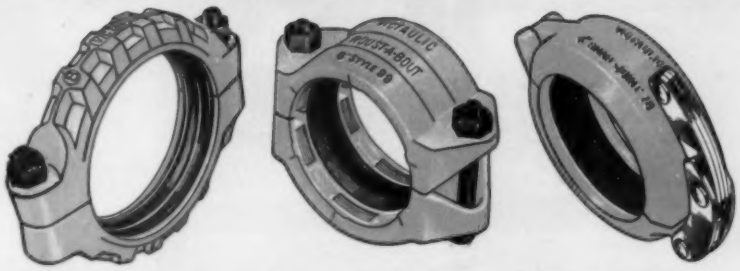
6-8 American Geophysical Union, thirty-eighth annual meeting, National Academy of Sciences, Washington, D. C.

7 American Gas Association, committee on underground storage, operating section, Mark Hopkins Hotel, San Francisco.

VICTAULIC®

METHOD OF PIPING

VICTAULIC HAS EVERYTHING...



VICTAULIC COUPLINGS
Simple, fast, reliable. *Styles 77, 77-D,* for standard uses with steel or spiral pipe, — *Style 75* for light duty. Other styles for cast iron, plastic and other pipes. Sizes ¾" to 60".

ROUST-A-BOUT COUPLINGS
For plain or beveled end pipe *Style 99.* Simple, quick, and strong. Best engineered and most useful plain end coupling made — takes a real "bull-dog" grip on the pipe. Sizes 2" to 8".

VICTAULIC SNAP-JOINTS
The new, boltless, speed coupling, *Style 78.* Hinged into one assembly for fast piping hook-up or disassembly. Hand locks for savings in time and money. Ideal for portable lines. Sizes 1" to 8".

COUPLINGS FOR EVERY PIPING JOB

VICTAULIC FULL-FLOW FITTINGS
Elbows, Tees, Reducers, Laterals, *a complete line*—fit all Victaulic Couplings. Easily installed — top efficiency. Sizes ¾" to 12".

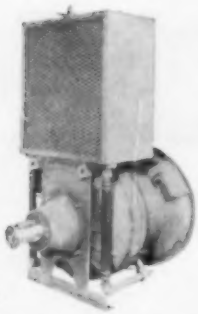
VIC-GROOVER TOOLS
Time saving, on-the-job grooving tools. Light weight, easy to handle — operate manually or from any power drive. Sizes ¾" to 8".

PLUS FITTINGS AND GROOVING TOOLS

"EASIEST WAY TO MAKE ENDS MEET"

Promptly available from distributor stocks coast to coast.
Write for NEW Victaulic Catalog-Manual No. 55-E-4

VICTAULIC COMPANY OF AMERICA
P. O. BOX 509 • Elizabeth, N. J.



***Left.* 16,000 Series Three-Stage Torque Converter**

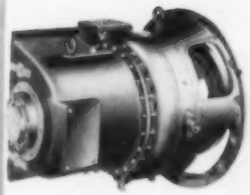
Will transmit up to 1000 hp at 1500 rpm. Seven specific torque ratings from 260 to 600 lb.-ft. SAE 00 flywheel housing size or clutch between flywheel and converter.

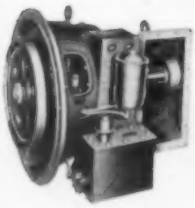
***Left.* 13,800 Series Three-Stage Torque Converter**

To 600 hp at 1800 rpm. Eight specific torque ratings from 230 to 540 lb.-ft. SAE 00 or 0 flywheel housing sizes. Spider drive or clutch between flywheel and converter. Output shaft takes full sidepull.

***Right.* 11,500 Series Three-Stage Torque Converter**

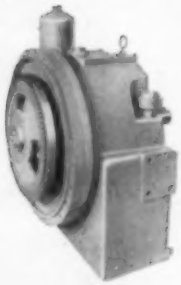
From 60 hp at 700 rpm to 425 hp at 2200 rpm. Six specific torque ratings from 230 to 450 lb.-ft. SAE 0 or 1 flywheel housing sizes. With or without clutch. Full range of input-output combinations available.





***Left.* 10,000 Series Three-Stage Torque Converter**

From 40 hp at 700 rpm to 335 hp at 2400 rpm. Eight specific torque ratings from 200 to 500 lb.-ft. SAE 1 flywheel housing size. With or without clutch. Full range of input-output combinations available.

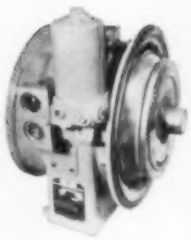


***Left.* 1500 Series Single-Stage Torque Converter**

From 30 hp at 1100 rpm to 207 hp at 2500 rpm. Five specific torque ratings from 165 to 330 lb.-ft. SAE 1 or 2 flywheel housing sizes. With or without clutch. Various input-output combinations available.

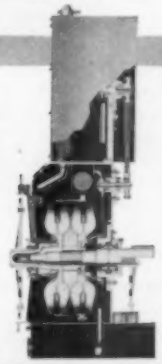
***Right.* 1300 Series Single-Stage Torque Converter**

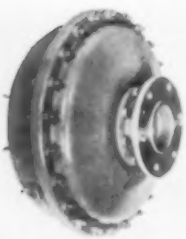
From 30 hp at 1450 rpm to 212 at 3200 rpm. Five specific torque ratings from 165 to 330 lb.-ft. SAE 2 flywheel housing size and SAE 2 or 3 output spacer housing. Output adaptable to Twin Disc SP-111 PTO.



***Right.* Disconnecting Fluid Power Take-Offs**

Model 27 HUD for engines to 850 hp at 1525 rpm. SAE 00 flywheel housing size. Model 21 HUD for engines to 580 hp at 1900 rpm. SAE 0 flywheel housing size. Both models equipped with radiator and fan and output shafts permit full sidepull.





***Left.* Fluid Couplings and PTO's**

Fluid Couplings from 7.4 to 27 inches, to 850 hp. Speeds to 5400 rpm. Fluid Power Take-Offs in 21, 17.5 and 14.5-inch sizes, to 500 hp. Speeds to 2700 rpm. SAE 0, 1 and 2 sizes. Ideal for high inertia loads and cushioning out shocks and damaging pulsations.

***Left.* HYDRO-SHEAVES®**

Combine fluid drive benefits with V-belt economy and convenience. For pumping jacks, shale shakers and many other oil field applications. Permit smaller motors, minimize equipment wear, reduce power factor. Fractional to 50 hp at nominal motor speeds.

Oil field equipment manufacturers, owners and operators look to Twin Disc for

biased

recommendations because . . .

Twin Disc—and *only* Twin Disc—offers a complete line of fluid and friction drives . . . three-stage and single-stage torque converters from 30 to 1000 hp . . . fluid couplings from fractional to 850 hp . . . friction clutches and power take-offs to 1050 hp.

Regardless of the oil field equipment or machinery application, you can depend upon Twin Disc products for the most efficient and profitable means of transmitting power.

For high-capacity mud pumps, rotary tables and drawworks, Twin Disc Three-Stage Torque Converters prove ideal. Providing up to 6:1 torque multiplication, the three-stage torque converter continually compensates for varying load conditions within a wide application range.

Where maximum torque multiplication is not required, Twin Disc Single-Stage Torque Converters, multiplying torque up to 3:1, are widely accepted in oil field applications. These units are excellent for transmitting power on shallow hole drilling jobs, oil field service equipment and other power installations where mild torque conversion is required.

Where torque multiplication is not necessary, oil field equipment can still benefit through the use of Twin Disc Fluid Couplings and Fluid Power Take-Offs. These permit full input torque to be transmitted at all times, regardless of load conditions. Like torque converters, their fluid connection dampens out harmful vibrations and shock loads, thus relieving equipment from stresses and strains that eventually result in downtime. The fluid's "slip" characteristic compensates for sudden overloads.

Twin Disc's line of friction clutches is built for all oil field equipment where friction drives lend themselves most profitably. These units are adaptable to air, hydraulic and manual operation, thus meeting the widest degree of oil field requirements.

Write to Twin Disc Clutch Company today or see your local Twin Disc Dealer . . . for unbiased recommendations on the type of drive best suited for your specific oil field equipment.

Twin Disc Clutch Company, Racine, Wisconsin; Hydraulic Division, Rockford, Illinois . . . with parts and service facilities throughout most of the world.

TWIN DISC

TWIN DISC

Friction Clutches and Fluid Drives

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin • HYDRAULIC DIVISION, Rockford, Illinois

Branches or Sales Engineering Offices: Cleveland • Dallas • Detroit • Los Angeles • Newark • New Orleans • Tulsa

Easy, Quick to Install

. . . that's why using Glitsch Caps and Risers will allow your unit to go on stream with a minimum installation time. The removability feature also allows cleaning to be done either inside the tower or on the ground outside. The comparatively thin-gauge metal used in Glitsch assemblies cools off and heats up rapidly, which further reduces downtime.

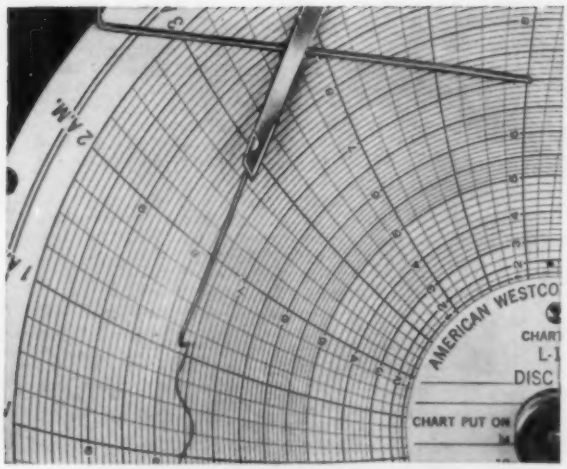
Over the years, we have designed more than 300 different cap and riser assemblies for every process requirement. We can furnish virtually any conceivable type and design—opened- or closed-slot caps; set-on, swaged, or pull-up risers; with wedge, quarter-turn cap, or stud hold-downs. Either round or rectangular assemblies are available in a full range of sizes and materials.

If you would like more information on Glitsch Cap and Riser Assemblies, Glitsch Truss-Type® Trays, or other Glitsch products and services, call our nearest office or write to us at P. O. Box 6227, Dallas. There is no obligation, and you will be pleased with the prompt and competent recommendations our representatives will make for your project.

DALLAS • CHICAGO • CLEVELAND • HOUSTON • LOS ANGELES • NEW YORK • TULSA • UXBRIDGE

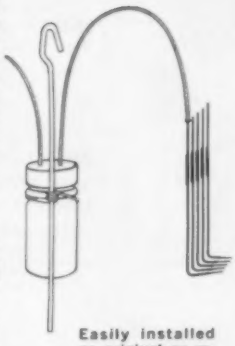
Glitsch Bubble Caps

8-10	Canadian Institute of Mining and Metallurgy, eighth annual convention, petroleum and natural-gas division, Macdonald Hotel, Edmonton.
8-10	American Gas Association, Pacific Coast Gas Association, gas supply, transmission, and storage conference, Mark Hopkins Hotel, San Francisco.
9	Panhandle Producers and Royalty Owners Association, annual meeting, Herring Hotel, Amarillo, Tex.
9-10	Fourth annual heat-transfer conference, Oklahoma A. & M. College, Student Union Building, Stillwater, Okla.
9-10	Symposium on use of surface active agents in water flooding, Pennsylvania State University, department of petroleum and natural gas, State College, Pa.
12-15	Liquefied Petroleum Gas Association, annual meeting, Conrad Hilton Hotel, Chicago.
13-15	Industrial Waste Conference, sponsored by Purdue University, Purdue Memorial Union Building, Lafayette, Ind.
13-16	American Petroleum Institute, division of refining, midyear meeting, Sheraton Hotel, Philadelphia.
13-17	American Petroleum Institute, safety and fire protection committees, Hotel President, Kansas City.
14-16	American Petroleum Institute, central committee on highway transportation, Cosmopolitan Hotel, Denver.
14-16	Industrial Nuclear Technology Conference, sponsored by Armour Research Foundation of Illinois Institute of Technology and Nucleonics Magazine, Museum of Science and Industry, Chicago.
16-17	American Right of Way Association, third annual national seminar, Conrad Hilton Hotel, Chicago.
16-17	American Petroleum Institute, division of production, Pacific Coast district meeting, Hotel Biltmore, Los Angeles.
16-18	Geological Society of America, southeastern section, annual meeting, Morgantown, W. Va.
19-22	Texas Independent Producers and Royalty Owners Association, Galvez and Buccaneer Hotel, Galveston, Tex.
20-22	American Petroleum Institute, division of transportation, central committee on transportation by water and tanker corrosion symposium, San Francisco.
20-22	American Gas Association, chemical, engineering, and manufactured gas production conference, Balmoral Hotel, Bal Harbour, Fla.
20-23	American Society of Mechanical Engineers, twenty-ninth annual conference and exhibit of the oil and gas power division, Kentucky Hotel, Louisville, Ky.
21-23	Pennsylvania Gas Association, annual meeting, Pocono Manor Inn, Pocono Manor, Pa.
23-24	Kentucky Oil and Gas Association, annual membership meeting, Hotel Phoenix, Lexington, Ky.
23-24	American Institute of Mining, Metallurgical, and Petroleum Engineers, third annual joint meeting, Rocky Mountain petroleum sections, Northern Hotel, Billings, Mont.
23-24	Western Petroleum Refiners Association, southwest regional technical-industrial relations meeting, Hotel Paso del Norte, El Paso, Tex.
27-29	Rocky Mountain Oil and Gas Association, twelfth annual convention, Denver.
29-31	Annual short course in gas technology, Texas College of Arts and Industries, Kingsville, Tex.



CANNON PENS

assure legible charts ...eliminate inking problems



Easily installed as original or replacement equipment in all standard recording instruments. Available in five sizes and angles — special pens upon request.

Cannon controlled-flow capillary meter pens provide exceptional dependability and long life with minimum maintenance. Easy to install, these precision pens produce accurate chart records of maximum legibility and continuously record up to a full year without refilling reservoir.

- **Ends Unrecorded Intervals.** Unaffected by pulsating flows, chart speeds, rapid pen movement.
- **Sealed Ink Supply.** Prevents clogging from atmospheric contamination.
- **Two-Way Ink Flow.** Stainless steel writing point is positioned above ink level in reservoir and ink flows in either direction by capillary action—eliminates smearing, blurring.
- **Special Pens.** Designed and produced to customer specifications where special inking problems make standard pens impractical.

Write today for information

AMERICAN METER COMPANY
INCORPORATED (ESTABLISHED 1836)

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SUPPLIERS TO THE GAS INDUSTRY for Ironcase, Tinned Steelcase, Aluminumcase and Welded Steelcase Meters • American-Westcott Orifice Meters Instruments • Reliance Regulators • Apparatus • Valves

So SIMPLE
We Can
Adapt It
to ANY
LIQUID LEVEL
CONTROL JOB
A sleeve, raised and lowered within a non-magnetic tube, attracts or releases an Alnico magnet attached to a mercury switch. Basically, this is Magnetrol.
MAGNETROL

AS DEPENDABLE AS MAGNETIC FORCE ITSELF

● No matter how specialized the liquid level control application, adapting Magnetrol to meet it presents no problem. Whether it's for high pressures, high temperatures, corrosive liquids or any other condition, a few "standard" modifications and the job is done! Operation is so simple no changes in basic design are needed. That's why Magnetrol "fits" practically any application — why "specials" are so often standard with us.

Because of the utter simplicity and dependability of its magnetic principle, Magnetrol has *infinite operating life.* There are no wearing parts to get out of order.

Magnetrols are available for controlling level changes from .0025-in. to 150-ft., with single or multi-stage switching. Our experienced engineering staff is at your service.

MAGNETROL, Inc.

WHY NOT MAIL THE COUPON—NOW

MAGNETROL, Inc., 2107 S. Marshall Blvd., Chicago 23, Illinois
Please send me catalog data and full information on Magnetrol Liquid Level Controls.

Name_____
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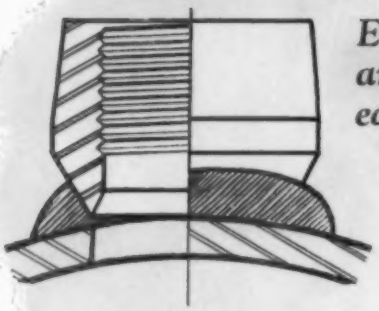
A New Line of Branch Connections

W-S COUPLETS



Economical and easy-to-install

Readily modified for small diameter installation

W-S Couplets are designed to function as universal outlet connections for tanks, process vessels and pipelines. They eliminate the need for large, expensive field inventories and costly delays in fabrication.

On most tank, and large piping installations they are used as received. On those few applications where attachment is to be made to a small diameter pipe, the W-S Couplet is easily modified by contouring the welding end with an acetylene torch to mate with the curvature of the pipe diameter. Couplets are made with extra length and heavy wall to permit contouring without detriment to the threaded or socket end.

W-S Couplets are available in sizes ¼" through 2", with screw-end or socket-welding dimensions ... also in a 90° elbow.

Send for Bulletin CP-1-57. Write to W-S Fittings Division, H. K. Porter Company, Inc., P. O. Box 95, Roselle, N. J.

HKP W-S FITTINGS DIVISION
H. K. PORTER COMPANY, INC.

JUNE

- **3-5** Petroleum Electric Power Association, annual convention, Amarillo, Tex.
- **3-7** Oil-Heat Institute of America, thirty-fifth annual convention, Sheraton-Plaza Hotel, Boston.
- **4-6** Second annual Appalachian Underground Corrosion Short Course, West Virginia University, Morgantown, W. Va.
- **6** Pennsylvania Grade Crude Oil Association, thirty-fourth annual meeting, Penn-Sheraton Hotel, Pittsburgh.
- **9-13** American Society of Mechanical Engineers, semiannual meeting, Sheraton-Palace Hotel, San Francisco.
- **10-12** Interstate Oil Compact Commission, midyear meeting, Yellowstone Natonal Park.
- **10-14** Gordon Research Conferences, petroleum, Colby Junior College, New London, N. H.
- **16-21** American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.
- **17-21** Gordon Research Conferences, catalysis, Colby Junior College, New London, N. H.
- **19-21** Association for Computing Machinery, twelfth annual meeting, University of Houston, Houston.
- **20-21** Western Petroleum Refiners Association, Mid-Continent regional technical-industrial relations meeting, Broadview Hotel, Wichita.
- **20-22** National Oil Scouts and Landmen's Association, annual meeting, Hotel Cosmopolitan, Denver.
- **23-27** Canadian Gas Association, Jasper Park Lodge, Jasper, Alta.

JULY

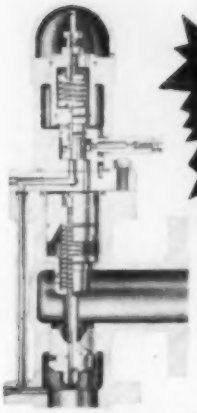
- **8-19** Industrial Statistics for the Process Industries, second annual conference, sponsored by American Society for Quality Control and the University of Oklahoma, Lockett Hotel, Norman, Okla.

AUGUST

- **26-28** Seventeenth annual Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.
- **28-30** Instrument Society of America, International Symposium on gas chromatography, Kellogg Center, Michigan State University, East Lansing, Mich.

SEPTEMBER

- **3-5** Pacific Coast Gas Association convention, Fairmont and Mark Hopkins Hotels, San Francisco.
- **5-7** New Mexico Geological Society, eighth annual field conference, southwestern Colorado.
- **8-13** American Chemical Society, 132nd national meeting, New York City.
- **9-10** Independent Natural Gas Association of America, annual meeting, Shamrock Hilton Hotel, Houston.
- **11-13** National Petroleum Association, fifty-fifth annual meeting, Traymore Hotel, Atlantic City, N. J.
- **19-21** Rocky Mountain Oil Show, fairgrounds, Casper, Wyo.
- **23-25** American Society of Mechanical Engineers, petroleum mechanical engineering conference, Mayo Hotel, Tulsa.
- **26-27** Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.
- **26-27** Mid-Continent Oil and Gas Association, Louisiana - Arkansas division, Roosevelt Hotel, New Orleans.
- **30-Oct. 2** American Oil Chemists' Society, 1957 fall meeting, Netherland Plaza Hotel, Cincinnati.



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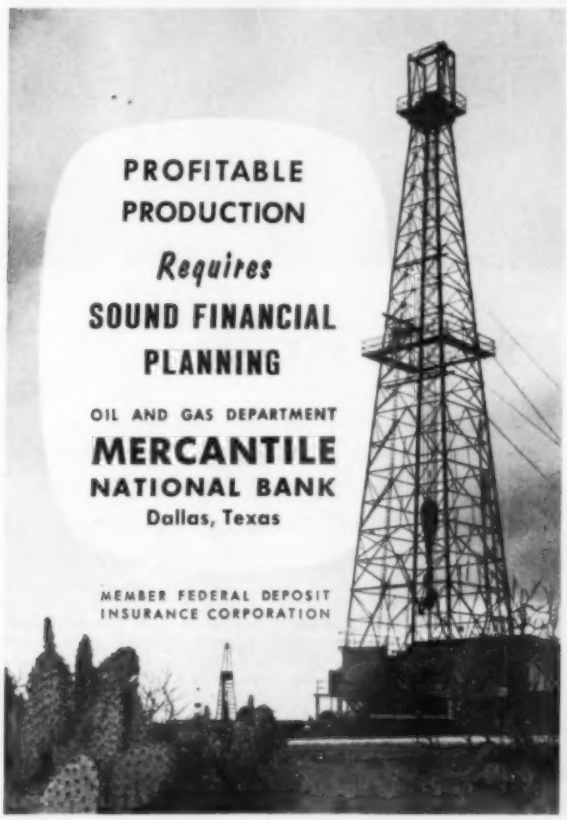

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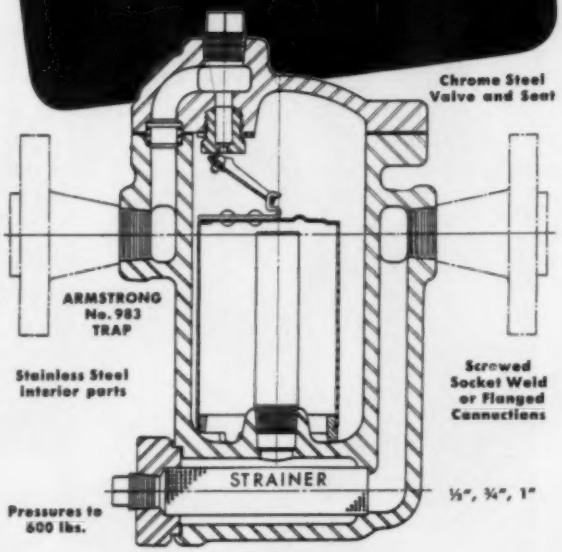

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JOURNALLY SPEAKING . . .

Absord or Adsorb?

DO you like your processing information absorbed or adsorbed?

Going over the proofs of the field-processing articles for this special issue sent us scurrying to the dictionary to look up the difference between absorb and adsorb. (We've looked it up before, but never can remember.)

We learned that absorb means to soak up like a sponge. That's what a chemical engineer does with processing information. On the other hand, adsorb means to condense and hold in an extremely thin layer. That's us. Whatever information about processing we have been able to condense into our cranium is held in an extremely thin layer, extremely thin.

Whichever method you use, you can apply it to the stuff in this issue. If you're a process man yourself you can find plenty of good dope to soak up like a sponge. Very absorbing reading matter for people who have absorption-type brains.

But if you are like ourself and just want to condense a thin layer of information, you can use a mental adsorption process and skim off enough to get a general idea of the important things that are happening in field processing and some of the problems the boys in that department are struggling with.

For instance, from the article on gas dehydrators we adsorbed the idea that after 20 years some processors are going back to using calcium chloride to dry out the gas, having finally learned ways to handle the stuff and keep it from corroding out the whole plant.

Now there's something we can understand. We once tried to dry out a damp basement by setting a dozen tin pans of calcium chloride around the floor. After trying to scrape up the gick that overflowed and leaked through the holes it ate in the pans, and trying to get rid of the gooey mass, we know that calcium chloride will absorb water all right, but we would rather have a damp basement than mess around with that stuff. Mighty glad to know that somebody has found a better way to handle it.

Then from the piece about pipelining L.P.G. we adsorbed the idea that the smart boys at Phillips are 10 years ahead of everybody else, having made all the mistakes that could possibly be made. Now, it appears, other people are about to profit by Phillips' experience and go into pipeline transportation of propane in a big way.

This recalled to us the terrific hullabaloo right after the war about the shortage of pressure tank cars for shipping propane. It seems that everybody and his brother wanted to buy the surplus cars the Government had for sale, but the only people who could buy them legally were veterans and their brothers. A lot of people adopted veterans as brothers and thus got into the L.P.G. business. But if the stuff is now on the verge of being distributed all over the country by pipelines, the business may soon be revolutionized.

But watch out, or you may be in the ice business. If propane leaks out into the air it evaporates so fast that the process cools everything in the vicinity and freezes any moisture that happens to be around. Look what happened to a leak in damp ground. It froze so solid they couldn't crack it with a bulldozer. They had to shut the line down for a week until the earth thawed out.

We could have told them that. Out in the South Pacific the G. I.s learned how to cool their beer by this process. They would stack the cans on the sun-drenched beach, cover the heap with white coral sand, and dump a drum of 100-octane aviation gasoline on the whole pile. Then they would sit under a palm tree for about 20 minutes to work up a thirst, by which time the gasoline would have evaporated and the beer was chilled to just the right temperature. It was Yankee ingenuity like this that won the war. The Army never publicized this scientific triumph, possibly because it would not have been appreciated by motorists holding A-cards or by refiners busting their britches to meet their avgas quotas.

You see how mental adsorption works? The layer may be extremely thin, but you can condense the darndest things.

But if you are the absorption type, you most certainly can get a lot more useful information out of this issue.

—*Henry D. Ralph.*

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The new gas bill: better than nothing?

A DEAFENING silence surrounds the new Harris natural-gas bill. Nobody seems to be very much for it, and the only ones who have come out against it are a few hardhead senators who announced their opposition before studying its terms.

The bill is a compromise, and the kind of compromise that pleases nobody. But it looks like a carefully thought-out compromise, reasonably fair to all concerned, and about the best that could have much prospect of general acceptance.

The question is: Is this a something that is better than the nothing that now exists? Is a truce without victory to anybody preferable to continued war and uncertainty?

ONE POSITIVE FACTOR is that the bill would end the chaos now existing in the gas industry. The Federal Power Commission is hopelessly mired in an impossible regulatory morass. Any decisions it may make will be appealed through interminable court litigation. No segment of the industry knows where it stands. The least that can be said for the bill is that it lays down some ground rules.

Gas consumers would seem to be well protected except for a guarantee against any increase in prices. And with inflationary factors at work and with gas increasingly more costly to find, such a guarantee is impossible. The bill should encourage increased supplies at justifiable prices.

Distribution companies get most of what they were asking for by elimination of all indefinite price-escalation devices, plus a formula for FPC control of prices, plus the right to have a say on field prices. In return for surrendering utility-type control of producers, they get assurance of more gas for the future.

Pipeline companies stand to gain all around. The bill would spur their own gas production and remove many contract and expansion difficulties.

PRODUCERS ARE BETWEEN the rock and the hard place. Acceptance of the bill is surrender to the principle of federal control of their prices—a bitter pill to swallow. But federal control has been a reality for 3 years, and its complete removal within the foreseeable future is a political impossibility.

But it does relieve producers of all controls except on prices. And it regulates only some prices, and those to a limited degree. Those prices still regulated would be freed from the utility concept and subjected to a new formula that looks practical enough to be worth a trial.

The bill is a sincere attempt to find a way out of the present intolerable situation. Producers could live under it. It is probably the best they can hope to get. Confronted with a condition, not a theory, the practical course is to accept it, even though with reluctance.

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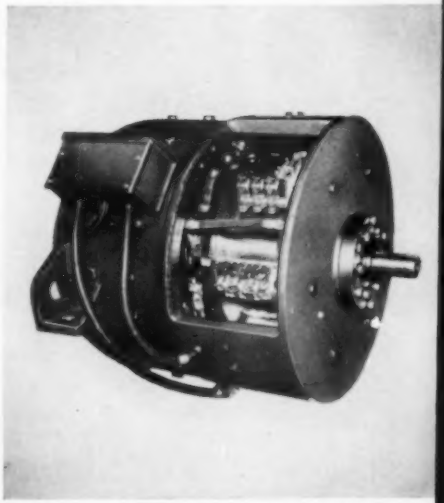

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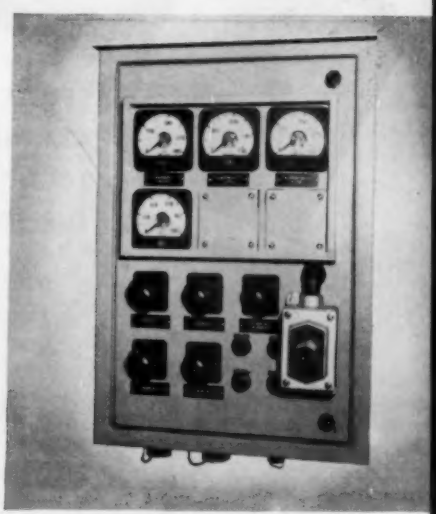
GE752H2 direct current, 1000 hp motor with top-mounted blower assembly.



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the OIL AND GAS JOURNAL

April 29, 1957

Gray Rules Imports Excessive

● Eisenhower quickly orders an investigation. Double action catches industry by surprise. It came just after Texas house had sent a resolution asking restrictions, and the nation's independents were preparing to chart a joint course of action

WASHINGTON.—The industry is on notice this week that imports will be cut.

Whether the cutting will be done voluntarily or by the Government is a matter to be decided quickly.

The long-threatened axe finally fell on excessive oil imports last week. In quick succession:

...Mobilization Director Gordon Gray certified he "had reason" to believe crude imports threaten to impair the national security.

...President Eisenhower announced he would have an investigation made under Section 7 (the national security clause) of the Trade Agreements Act to "determine the facts." He also asked Gray again to study the chances of getting imports cut by voluntary action.

The administration decision to do something about imports came just as independent producers were girding for a showdown fight on the issue. The whole matter had been scheduled for a thorough going-over at this week's convention of the Independent Petroleum Association of America at Biloxi, Miss.

The action also climaxed 2 years of study by the Cabinet Fuels Committee and efforts to induce importing companies to bring their imports in line with the ratio they held to domestic production in 1954.

Flemming affirmed . . . Gray's finding that imports threaten national security confirmed a previous finding by his predecessor, Arthur S. Flemming.

Gray's action was based on reports filed with the Office of Defense Mobilization last month by more than 60 importing companies.

Those reports showed total imports planned for the last 6 months of this year would aggregate 1,261,000 bbl. daily. This is 17.4 per cent of estimated domestic crude output. Under the 1954 ratio of 10.34 per cent, the allowable import should be 751,000 bbl. daily.

That meant, Gray said, that planned imports would be 510,000 bbl. daily in excess of the ratio.

Gray pin pointed the situation by knocking the West Coast out of the picture. He declared this is a deficiency area, whereas the problem is centered in Districts 1 to 4. Scheduled imports into those four districts total 943,000 bbl. daily against a ratio of 712,000 bbl., resulting in an excess of 231,000 bbl. daily.

In sending the problem to the White House, Gray wiped out the distinctions made by Flemming in his effort to get voluntary control. Flemming had practically limited his effort to oil from the Middle East. But Gray said he was passing on imports across the board.

Imports picture . . . Here is how the importers broke down their schedules by areas of production:

Planned imports from Canada through the last half of this year total 415,000 bbl. daily against 129,000 bbl. daily for the same 1955 period and an average of 7,000 bbl. daily for all 1954.

Imports from Venezuela would be 1,115,000 bbl. daily against 782,000 bbl. in 1955 and 352,000 bbl. through all 1954.

Middle East imports would be 743,000 bbl. daily against 590,000 bbl. in 1955 and 213,000 bbl. through all 1954.

Gray pointed out to the President that a "quite extensive" investigation has been made of the effect of crude imports on national security.

"The investigation clearly established that the rate of imports could reach a point at which the incentive for exploration and development in this country would be so reduced as to make us dependent upon overseas oil supplies to meet our national energy requirements," Gray said.

"Further, the investigation gave substantial support to a finding that a significant increase in imports over the level of imports in 1954, unless accompanied by a similar increase in domestic production, would threaten this impairment in our national security.

"Upon the basis of present imports and their trend over the last several years, together with forecasts of their trend in the next few months, I do hereby advise you, pursuant to Section 7 of the Trade Agreements Extension Act of 1955, that I have reason to believe that crude oil is being imported into the United States in such quantities as to threaten to impair the national security."

Eisenhower replies . . . In a memorandum to Gray, Eisenhower agreed there is reason for concern.

"I shall, therefore, cause an investigation to be made to determine the facts," the President said.

The President asked that Gray's new effort to get voluntary limits on imports should go along at the same time as the inquiry.

"It seems to me that there would

be advantages in adjusting imports in that fashion if it is practicable to do so," Eisenhower said.

Further, he added, if the presidential inquiry shows that security is in danger, "it will be important for me to know whether an adjustment of the imports can be accomplished voluntarily, or whether other measures may be necessary."

There was no indication from the vacation White House at Augusta, Ga., how the investigation would be made. Gray, however, theorized it might be turned over to a committee or commission of citizens outside the Government.

Gray already has had talks with importers regarding their new schedules. Apparently their failure to revise them substantially led to his decision to send the matter to the President.

His new effort for voluntary controls will be made by personal talks with the policy officials of major oil companies. They will not be called in as a group, he said.

Gray's aim . . . Out of these talks Gray hopes to get a clear idea whether the import situation is actually as threatening as it now appears.

Gray said there are a number of factors to be studied. These include the geographic location of sources of supply, historic import patterns, conditions in this country and the position of individual companies. Some with import plans now were not substantial importers in 1954.

Gray made it clear, however, that his effort will not be another 2-year job. It will be wound up in a matter of weeks, not months, he said.

Gray refused to say whether he would demand that the importers get back to the exact level of the 1954 ratio. He said he would not be bound by that precisely. The acceptable import level may be a little above or below the cabinet committee's recommendation.

There is some question on how far the President could go in controlling imports under the national security clause. Gray admitted it is written in very broad language.

Uncertainty over his powers may lead Eisenhower to ask Atty. Gen. Herbert Brownell, Jr., for an opinion interpreting the law. But Gray said the intent of Congress in putting the provision in the Trade Agreements Act was to give the President broad authority.

Independents surprised . . . The sudden action by Gray surprised independent oil producers.

Many had told newsmen privately last week they thought Gray wouldn't act and that the only course was to take the fight on imports back to Congress for a more definite law. They claimed voluntary controls had broken down and the industry was threatened by the rising tide of oil starting up again in the Middle East.

Leaders of the I.P.A.A., meanwhile, had laid plans for definite action. For example:

. . . Robert L. Wood, I.P.A.A. president, only last week asked Gray to release the import schedules recently filed with ODM and further requested Gray to reveal what action he planned.

. . . The I.P.A.A. imports policy committee scheduled a meeting and planned to report to the association convention this week at Biloxi.

. . . A post-convention gathering of 19 domestic oil and gas producer associations was called by Wood after the I.P.A.A. session Tuesday. Wood

ODM'S GORDON GRAY
. . . A surprise for the oil industry.

told the associations "we are reaching a crucial point of our cooperative effort to obtain relief from excessive imports."

The administration move now will give independent leaders a chance to look at the whole problem in a new light.

How to control . . . One big question remaining is how the imports will be restricted. Independents have a variety of proposals on this score. Some being advanced are:

. . . A stiff tariff on all shipments exceeding the 1954 ratio of imports to domestic production.

. . . Quotas for importers but allowing entry only on the same ratio imports bore to 1954 domestic production.

. . . Allowing importers a percentage of the current U. S. market and assigning quotas.

. . . Restricting imports to percentage of U. S. refinery runs.

Texans riled . . . The double-barreled Washington action came a day after the Texas Legislature approved a stinging resolution condemning unfettered imports.

The lawmakers called on the President to take action after charging that:

. . . Large cuts in Texas allowables since March reflect imminent opening of Suez Canal. This will free an uncontrolled flood of foreign oil into this country.

. . . Allowable cuts since March will cost state revenues more than $20 million during coming biennium.

. . . Imports are far above 1954 safe maximum level.

. . . Domestic oil gets what's left of the domestic market after imports. This is caused by lack of restrictions on imports while domestic production is held to market demand.

. . . Oil importers are being subsidized by federal Government. This happens through: Direct cash payments to rulers of Middle East nations, tanker subsidies of $745 million in tax writeoffs on 52 ships and diplomatic and military support to protect fields owned in that region by international oil companies.

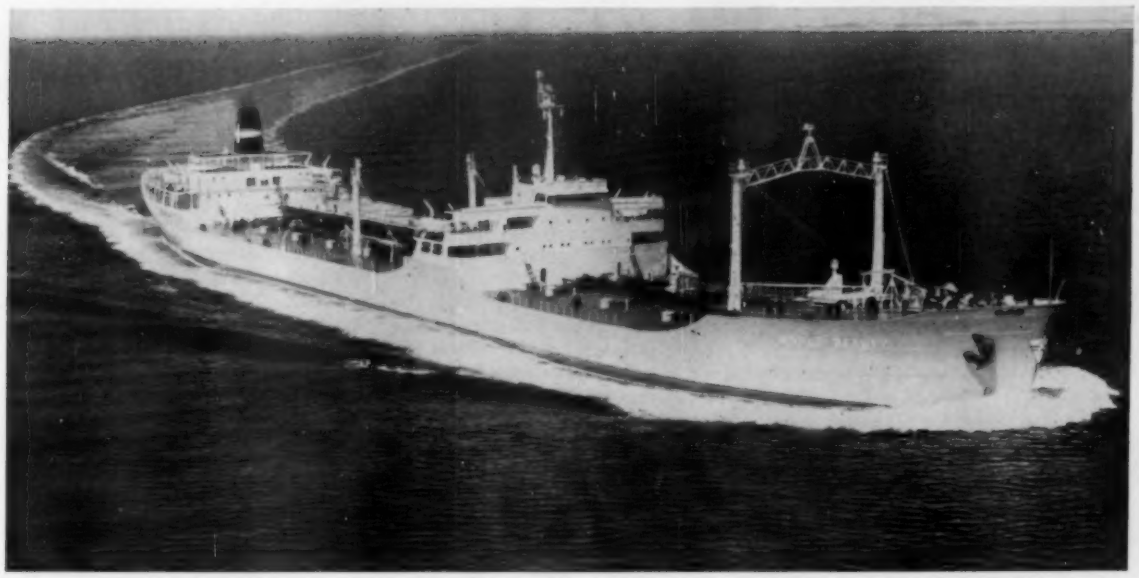
. . . Oil importers are using tax statutes to obtain U. S. tax credits for amounts paid to foreign rulers. They thus obtain aid in foreign development at the expense of domestic production. Development of reserves in this country is lagging due to these tax credits and subsidies.

. . . Importers guarantee certain volumes of oil production to rulers of Middle East countries and restrict domestic production to make this possible.

. . . Operation of Texas pipelines by importer affiliates provides a devious but effective means of holding crude oil in the interior of the state by failing to enlarge and extend the lines.

. . . Importer members of Middle East Emergency Committee were given antitrust immunity to help Europe through the oil crisis. The MEEC failed to divert U. S. imports to Europe, cut refinery runs to free crude here for export, or changed their refinery yields to produce needed fuel oils.

. . . Importing companies do business in Texas, yet their action in importing excessively suspends operation of Texas conservation laws, discriminates against domestic producers, and penalizes the revenue and thus the services of the state.



American Champ: The 42,000-ton World Beauty, the biggest tanker ever built in America, plows the Atlantic in a deep-sea shakedown cruise off the coast of Boston this month. The supertanker, launched in January, can haul 392,857 bbl. of crude. She is 737 ft. long, 102 ft. wide, and has a 37½-ft. draft. The World Beauty was built for Stavros S. Niarchos in Bethlehem Steel Co.'s Quincy, Mass., shipyards. Niarchos has a 106,500-ton tanker on order in America. The largest tankship now afloat is the 84,730-ton Universe Leader, built in Japan.

Royalty Fuss Curtails Drilling

LOS ANGELES.—California operators are taking an increasingly dim view of the legislature's attempts to change royalty provisions of the Cunningham-Shell Act.

Olen Lane, vice president of Continental Oil Co., said last week the C.U.S.S. offshore group's newest core boat will be put in mothballs July 1. Another small core boat, the Submarex, is up for sale. Besides Continental, the C.U.S.S. group includes Union Oil Co., Shell Oil Co., and Superior Oil Co.

The political climate is so unfavorable, Lane said, that the group feels it economically unwise to continue its expensive offshore coring program. However, the group will probably submit bids, when and if leasing is resumed. Indications are that this will be at least a year away.

Lane said the present efforts to amend the tidelands act to provide a sliding-scale royalty rate for wildcat acreage would wreck California's offshore exploration program.

Touching off Lane's remarks were efforts of three state assemblymen to change the royalty rates. The three, Allen Miller, Bruce Allen, and Joseph Shell, have amendments before the assembly now. The amendments are:

... **The Miller amendment,** which calls for either a sliding-scale royalty rate with a 16⅔ per cent minimum plus a cash bonus, or bidding on a straight royalty basis with no cash bonus involved.

... **Allen's amendment,** which is identical to Miller's.

... **The Shell amendment**, which would permit the state lands commission, at its discretion, to lease offshore lands either on the present flat 12½ per cent royalty or a sliding scale with the 12½ per cent minimum.

Lane held out one hope for resolving the dispute. The industry would probably go for a flat 16⅔ royalty on wildcat acreage. But, he warned, a sliding scale would sabotage the entire offshore program.

Two Producers Extend Aneth

DENVER.—Two new stepouts in Aneth field have extended the big play in the Paradox basin a mile northwest and a mile west. Both are in San Juan County, southeastern Utah.

Carter Oil Co. 1 Hickman-Federal, a mile northwest of the field's limits, flowed while testing the upper Hermosa lime at 6,130-80 ft. Most of the 30 wells in the area are producing from the Paradox lime. Only two have tapped the upper Hermosa.

The west extension was brought in by Three States Natural Gas Co. at its 2 Arrowhead. It flowed 70 bbl. of oil per hour from Paradox perforations at 5,628-46 ft. Oil also flowed from several other sets of perforations in the hole as testing continued.

Three States drilled the discovery well in the west extension to Aneth at Arrowhead last year. The well made 707 bbl. daily. The new producer is ½ mile southwest of the discovery. The 3 Arrowhead has been staked between the two.

New Computer Aids Kellogg

NEW YORK.—M. W. Kellogg Co. has begun an electronic computer program to expedite making material balances for processing units it designs and builds. In 15 minutes, the computer gives balances involving up to 40 components in terms of moles, gallons, and pounds. The same project would take an engineer a week to complete.

The program now makes it possible for Kellogg to evaluate a number of alternate flow schemes and to select the one which best serves the client. In its first application on an absorber-stripper, the computer saved 12.5 per cent in materials and incremental utilities.

This is only the beginning. Kellogg plans to expand the computer program to embrace entire refinery processing schemes. This project is expected to be in operation shortly.

Labor Showdown Is Near

Wage offers of 4 to 6 per cent are catching hold all over nation; now it's up to O.C.A.W. to accept or call strike

A SHOWDOWN is near in the Oil, Chemical, and Atomic Workers International Union's drawn-out campaign for big wage increases this year.

The union's powerful bargaining-policy committee is faced with these alternatives:

. . . Accept management's offers to increase wages in the neighborhood of 5 per cent.

. . . Set a date for a nation-wide strike.

After more than 4 months of pressing for a 27-cent hourly increase, the 105,000-member O.C.A.W. has received no offers higher than 5 per cent (about 13½ cents an hour). However, Sun Oil Co. has offered its independent unions 6 per cent—the highest offer so far this year.

The 5 per cent offer to O.C.A.W. began catching hold early in April. Since then it has spread to Socony Mobil Oil Co., Shell Oil Co., Pure Oil Co., Phillips Petroleum Co., Standard Oil Co. (Ohio), Aurora Gasoline Co., International Refineries, Inc., and Republic Oil Refining Co.

Marketing workers have accepted Socony and Pure's offers in the Detroit area, and refinery workers have accepted 5 per cent at Aurora's 42,000-bbl. plant at Detroit.

At International Refineries' 11,000-bbl. plant at Wrenshall, Minn., management offered O.C.A.W. workers a 5 per cent increase 2 days after a strike was called. The workers accepted the offer.

But O.C.A.W. President O. A. Knight does not regard these agreements as setting a pattern because the marketing settlements were "local" and the refinery settlements involved independent companies.

Asked if the O.C.A.W. bargaining-policy committee would be called on whether to accept the 5 per cent offers as a pattern, Knight said last week that the 52-man group might meet in the near future.

"At that time, if free collective bargaining has run its course, the committee will undoubtedly take a hard look at all the facts, including the fact that a strike may be necessary to bring an equitable wage settlement."

Sun's 6 per cent . . . One reason behind the showdown delay might be Sun Oil Co.'s 6 per cent offer of last week.

The Sun offer means a slight victory for the O.C.A.W., although the offers were made to independent unions and not the O.C.A.W. This is the highest offer so far in 1957 oil-industry negotiations.

Another delaying factor might be Sinclair Oil Corp.'s reluctance to make a counterproposal to O.C.A.W.'s demands. Sinclair has the only nation-wide contract with O.C.A.W., involving more than 10,000 workers. It expires June 14.

Sinclair met with O.C.A.W. early in March, but no agreement was reached. What Sinclair says could be the deciding factor, and set a national pattern.

Other settlements . . . One of the latest big companies to give 5 per cent increases to nonorganized employes is Continental Oil Co. Continental officials last week said the same offer would be made to organized labor.

Nonorganized employes of Magnolia Petroleum Co. and Plymouth Oil Co. have received 5 per cent increases.

Some members of the loosely organized Federation of Independent Oil Unions have accepted offers much lower than the federation's original demand for 25 cents.

The 6,300-member Independent Petrolum Workers of America accepted 4 per cent (about 10½ cents) from the Standard Oil Co. (Ind.) Whiting refinery in March.

Indiana Standard has offered the same 4 per cent to the 12,000-member Central States Petroleum Union, but the independent union is holding out for 5 per cent. Indiana Standard has not yet joined other major companies in offering 5 per cent.

Strike votes . . . More favorable strike votes were taken last week. On the Gulf Coast, O.C.A.W. workers at the big 282,000-bbl. Gulf Oil Corp. refinery at Port Arthur authorized a strike to back up their demands.

And on the West Coast, O.C.A.W. workers at The Texas Co.'s 60,000-bbl. Wilmington refinery and marine terminal voted 82 per cent in favor of authorizing a strike. Votes were also scheduled by Shell and Richfield Oil Corp. groups on the West Coast.

As prorating picks up again . . .

. . . Texas Shaves Allowable

AUSTIN.—The production picture in Texas is reverting rapidly back to its pre-Suez status.

Production continues to ebb with dropping demand. And areas where pipeline prorating has been chronic in the past 2 years have again become trouble spots following the brief Suez-inspired respite.

The Texas Railroad Commission April 19 shaved 70,173 bbl. daily off permitted flow in setting the initial allowable for May. This means a cut of more than 330,000 bbl. since late March when the allowable soared to an all-time high of 3,807,058 bbl. daily.

The 70,173-bbl. drop for May was from the flow permitted as of April 6, fixing the production level for the first of next month at 3,474,834 bbl. daily. Actually, the May rate will be almost 90,000 bbl. less than April's initial allowable.

The commission retained April's 16-day producing rate for May. The cut results in that this volume will be stretched out over one more calendar day in May. The reduction was the smallest the commission could make.

A majority of the crude buyers were dissatisfied. Most of them wanted less crude than this. Five asked for 15 days while only four sought 16.

Magnolia Petroleum Co. wanted the allowable whacked sharply to 14 days, which would have meant a whopping cut of around 400,000 bbl. daily. Sun Oil Co., on the other hand, suggested hiking the rate about 70,000 bbl. daily via 17 days.

Cosden prorating again . . . R. W. Thompson, Cosden Petroleum Corp., Big Spring, Tex., said West Texas operators again have distress oil on their hands.

Cosden and its subsidiary, Coltex Refining Co., Colorado City, Tex., have been forced to resume pipeline prorating in all fields in which they buy, Thompson said.

The two companies had previously prorated their purchases for about 2 years prior to the first of 1957. They were able to resell or otherwise market the excess oil the first part of this year, due to the Suez crisis.

Thompson said the two firms buy in Howard-Glasscock and Westbrook

fields. He pointed out that Shell Oil Co. also buys in the Howard-Glasscock and Permian Oil Co. buys in Westbrook.

The commission gave short shrift to Thompson's recommendation that Shell and Permian connections in these two fields be cut back proportionally to what Cosden could take from its connections there.

Oil Demand Grows

U. S. operators will drill 735,000 wells next decade

CASPER, Wyo.—The energy-hungry U. S. of 1966 will need 45 per cent more energy than it used in 1956. Petroleum is expected to supply about half of this.

To help meet the steadily increasing demand for oil, U. S. operators will drill 735,000 wells in the next decade, pushing production to 9,600,000 bbl. daily in 1966.

This is 2,400,000 bbl. daily more than the 1956 production, but it is still far short of the estimated U. S. demand of 14,300,000 bbl. daily forecast for 1966—an annual increase of 5 per cent.

These are the figures presented by Kenneth E. Hill, vice president of Chase Manhattan Bank, New York City, in an address before the Rocky Mountain spring meeting of the American Petroleum Institute's Division of Production here last week. Hill wrote the paper along with Harold D. Hammar, assistant vice president, and John G. Winger, petroleum economist.

To increase production as Chase predicts, U. S. oil men will have to discover an average of 3.6 million barrels of reserves per year in the next 10 years—15 per cent more than has been found in the past decade.

World demand . . . In the free world outside the U. S., demand will climb even faster. Chase thinks it will grow about 6.7 per cent per year, averaging 14,200,000 bbl. daily by 1966. Thus, the combined free-world demand will show a 6.2 per cent growth, totaling 28,500,000 bbl. daily in 1966.

Free-world reserves are adequate, but they're not evenly distributed in relation to consumption. As an example, Chase cites the U. S., which has a demand of 57 per cent, but only 15 per cent of the world's reserves.

The U. S. must find 1.5 bbl. for each barrel produced to provide an adequate inventory for growing demand. But Chase points out the U. S. has failed to do this the past 5 years.

watching WASHINGTON

. . . with Bertram F. Linz

Grain mixture too rich . . .

THE great idea of blending alcohol from surplus grain with motor gasoline is evaporating under the hot sun of high cost.

Bills have been offered in Congress over the past few years to require refiners to blend 5 per cent of alcohol with their motor fuel. A special commission set up by the last Congress has studied the idea—and found it isn't too good.

In the first place, nothing less than a 10 per cent blend would be practical or effective, the commission says. And that percentage would take more than the current surplus of grain.

Then, it would cost around $2 billion to build the plants to make the alcohol. That much private capital isn't going into a venture that might end when the surplus grain was used up. And there's no guarantee of an annual surplus. So the Government would have to pick up the tab.

And finally, the motorist would be presented with a bill of over $1 billion a year in higher prices for gasoline.

Imports—quota or tariff? . . .

SEN. JOSEPH C. O'MAHONEY of Wyoming thinks a tariff on foreign oil may be better than a quota in controlling imports.

O'Mahoney told Mobilization Director Gordon Gray that he should weigh this approach. The senator hasn't figured out what the rate should be. But he told Gray it should be one that would allow a reasonable level of imports "consistent with national-security requirements."

Voluntary control can't be relied upon, O'Mahoney believes. So some formal action may be necessary, although the administration is opposed to a quota.

O'Mahoney joined the growing ranks of those warning that national security will be impaired if a new flood of imports is allowed.

Recent hearings on the European oil lift by his joint subcommittee indicated that under the present pricing system a tariff would be absorbed by the producers and would not increase domestic prices.

Domestic producers long ago suggested a tariff. The big question is what sort would allow "supplementary" imports, yet keep out "supplanting" imports. If there were profit in bringing in any oil at all, why wouldn't there be profit in bringing in a lot, objectors asked.

FPC revives pricing issue . . .

THE use of original cost in determining the price independent producers should get for gas has again become an issue in the Federal Power Commission.

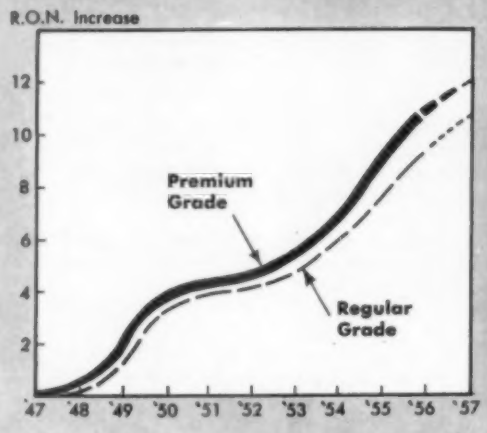
This was disclosed when the FPC halted hearings on a rate increase asked by Southern Production Co., Inc. A 3-month recess will allow the staff to make an original-cost study.

The FPC said it does not intend to inquire into acquisition costs of properties bought before June 7, 1954, "or go behind the cost to the person who first dedicates the property to the public use." But a majority held that cost may be a factor in prices of gas from reserves bought since the date of the Phillips decision.

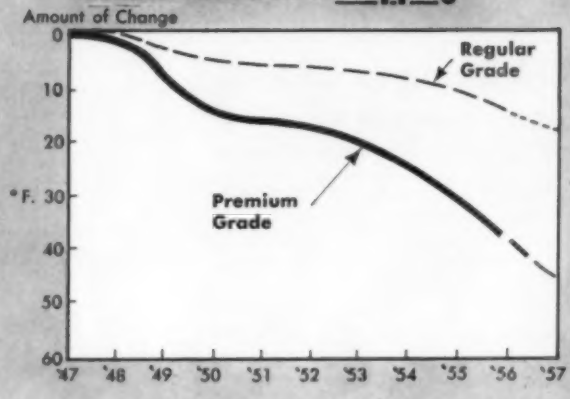
Southern Production's properties were bought by Sinclair Oil & Gas Co. last November. Southern Production acquired the holdings in 1950 from Danciger Oil & Refining Co. The study is expected to show whether the claimed acquisition cost is in excess of the original cost to developers.

The order was opposed by Commissioner Seaborn L. Digby. The FPC, he said, is adopting original-investment cost "at a time when those familiar with the problem are seeking to get away from a utility-type regulation for independent producers."

Research octanes in the last 10 years have been rising . . . so has volatility—



This means the maximum temperature at which an engine can handle motor fuel without trouble has been dropping—



Between car makers and refiners . . .

Showdown Is Due Soon on Volatility

THE refining and automotive industries are approaching a head-on collision on gasoline volatility.

The situation is this: Detroit designers are turning out engines which are getting more and more allergic to volatile gasoline. Refiners, meanwhile, still are increasing the vapor pressure along with octanes in their gasolines. Both defend their actions with sound and economic arguments.

But the person who pays is the American motorist. He may be the factor eventually persuading experts of both industries to compromise. At present the trend is for the motorist to foot a double bill: Expensive, high-octane gasoline and expensive, high-powered engines which aren't using all the fuel that's put in the tank.

This entire problem was frankly brought into the open by a panel discussion on gasoline volatility sponsored by the National Petroleum Association.

These experts agreed the trouble goes deeper than vapor lock alone, which has been a common complaint for years. Other aspects of volatility are involved. And the chief one is the increasing difficulty modern carburetors have in handling the dual liquid-gaseous phase that occurs with volatile fuels.

How it happened . . . Over the years fuel volatility has followed octanes upward like the tail of a kite.

This has arisen from the greater use of butane. This petroleum fraction has a great octane-blending value and has been one answer to a greater emphasis on easy starting.

But its volatility has created a basic problem: The maximum temperature at which carburetors can handle modern gasolines has been declining. In regular-grade gasoline, this temperature limit has dropped about 1.7° F. for every research-octane number increase. In premium fuel the temperature increment has been about 3.6° F.

Complicating this tendency is another factor: Under-hood temperatures are rising. Hood lines are trending ever lower and show no signs of being raised.

The all-important new-car styling currently calls for the low silhoutte on the front end. To make matters worse, the engine compartment is becoming cluttered with more and more accessories. They not only reduce heat rejection but in some cases also contribute to higher temperatures by adding to the load.

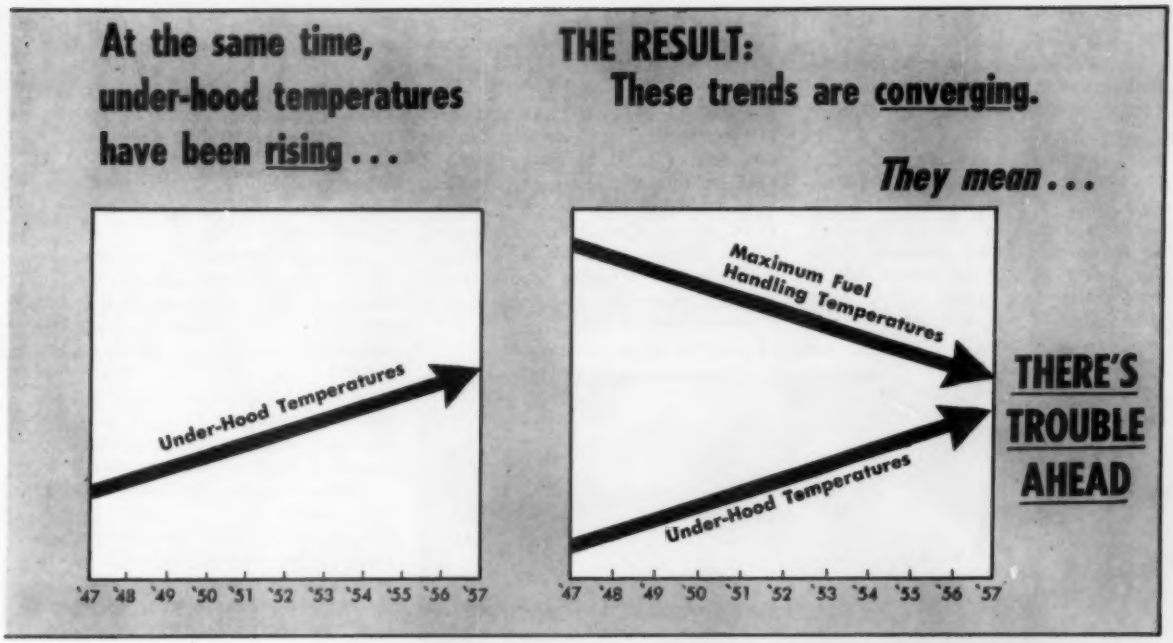
The consensus of the panel was that both industries have been barely escaping trouble to date. If trends continue, however, something will have to give.

Back off on butanes? . . . One approach, of course, would be to reduce volatility by cutting back on light ends, principally butane.

Refiners are not going to retreat on this front without a struggle. Aside from their value in quick starting, butanes provide a low-cost source of high-octane values. The refiner is hard pressed to maintain both research and road octanes. He cannot summarily dismiss butanes without serious economic loss.

Even when blended with very high-octane base stocks, butanes show up well where some other components lose their value. For example, take a full boiling range catalytic reformate as a base with a rating of 104 R.O.N. and 95 M.O.N. with 3 ml. TEL. With this high-quality base stock, normal butane shows a blending value of 104 R.O.N. and 93 M.O.N. Isobutane rates 108 R.O.N. and 102 M.O.N. Isobutylene shows blending values of 108 and 90, while alkylate for contrast rates 104 and 96.

Aside from its octane values, butane is increasingly necessary during warmup. The warmup time has been increasing during the last 10 years, from about 3 minutes to 10 minutes. If modern engines could stand more butanes, they would show better performance during this period. Since the trend is toward more "stop-and-



go" driving, the percentage of total operating time represented by warm-up is increasing.

Other light hydrocarbons, principally branched-chain C_5 and C_7, are going to loom more important in making higher-octane fuels. Volatility at the front end is a built-in necessity for modern gasoline. It cannot be toned down without a serious reshuffling of process plans.

The Detroit story . . . The opposite side of the butane argument is taken by automotive engineers.

They feel that fuels today are too volatile both in winter and summer. The fuel-engine relationship benefits from butanes only to a certain degree. Then carburetion becomes a problem. Today's carburetors are vastly more complex than those in use 20 years ago. Volatility was no problem then whatever.

The modern complex carburetor can handle vapor or liquid with ease. But it runs into difficulty when both vapor and liquid are present. What is known as "soapsuds" or "root beer" results from fuel vaporization in the float bowl.

Auto engineers have met this aggravating combination of higher inlet temperatures and more volatile fuels by venting the carburetors. Most 1957 models use carburetors with several of these vents. They are designed to prevent hot stalling and other upsets. Fine screens also are being used in the float chamber.

The Detroit people feel the necessary venting of carburetors entails some mileage loss. They claim the motorist is buying fuel that is vented and is not used in the engine. The auto-engine designers think they have been doing the best job possible to meet the difficult conditions, but they feel it's time for both industries to consider the high price a motorist is paying for highly volatile fuels.

The Detroit plea today is for a conservative attitude on volatility. Auto men feel that rapid warmup is not necessarily a function of volatility alone.

One report before the panel, however, shed a different light on relation of volatility to mileage loss. The report admitted carburetor venting can cause fuel loss but said a study failed to show any measurable correlation between volatility and mileage. It showed mileage is more a function of the 50 per cent point on gasoline. That's the temperature point in distillation where half the gasoline comes off.

A volatility test . . . A measure of the allowable volatility in gasoline over the year can be obtained from road tests of fleets representing average car population.

Critical cars are operated with a wide variety of fuels to study their vapor-lock characteristics. These tests show the per cent evaporated at 158° F. gives the same correlation to vapor lock as the distillation-curve slope at the 10 per cent point.

Relating data from these fleet tests to projected seasonal temperatures will permit the refiner to determine what per cent of cars on the road will be satisfied with a gasoline of a particular R.v.p. It is then up to the company to decide what per cent of critical cars it wishes to satisfy.

This correlation system can be used to tailor volatility to needs on a closer basis than the conventional three-a-year changes in R.v.p. If volatility is adjusted 10 times a year to meet expected weather over the marketing area, the company can reduce its overall volatility margin required to prevent vapor lock. The result is less "vapor-lock giveaway" or higher average volatility over a year's period.

One company report on a historical study of customer complaints illuminated the trend. The only volatility complaints 10 years ago concerned straight vapor lock. Today vapor-lock complaints are far less. The conclusion is that car manufacturers have learned to handle the vapor-lock problem. But the appetite of engines has become more specific regarding the volatility of gasoline from the front end to the middle boiling range.

What's ahead . . . The competitive situation in the automobile and refining industries is making the volatility problem hard to solve.

No car maker today is likely to engineer a car "critical" on gasoline volatility. Nor is any refiner going to step out on volatility. Competition on both sides makes it deadly for any car or any gasoline brand to assume the dubious title of "critical."

The result is that each industry is treading a narrow path. They

appear to be converging on trouble. When and if hotter engine compartments or more volatile fuels, or both, result in a critical impasse, some compromise is going to be in order.

Too many complex factors are involved to make a conclusive study of the relation between volatility and engine fuel appetites. So companies in both industries are staying close to the pack. If any tendency exists for giving ground on either side, it was not evident in the N.P.A. panel discussion. The solution will be worked out jointly as the need arises. But the tenor of the discussion indicated that a decision will soon be necessary.

Members of the panel included: Moderator, T. W. Legatski, Phillips Petroleum Co.; E. H. Scott, Standard Oil Co. (Ohio); George W. Pusack, Socony Mobil Oil Co.; Ray Potter, Ford Motor Co.; James C. Porter, Cities Service Research & Development Co.; J. P. Hamer, Esso Research & Engineering Co.; and Soma Kurtis, Aurora Gasoline Co.

"HOT-FOOT" treatment is given many shallow California wells. Heaters, such as the one above in Placerita field, circulate hot water at bottom of the well to raise temperature and increase oil flow to the bore.

Heaters Prove Popular

● California operators find bottom-hole heaters will kick up production 10 bbl. daily per well

LOS ANGELES.—Bottom-hole heaters are riding a popularity wave in California. Operators here are finding them the answer to stimulating the output of many low-volume, low-gravity oil producers.

A survey of the principal manufacturers and oil-company users shows about 600 wells are now getting the "hot-foot" treatment. There were only 200 such projects 2 years ago.

This 200 per cent gain was accompanied by a sudden interest in the heaters by major oil companies. The smaller oil companies had been the biggest users until recently. Now the majors are taking the lead. One company which already has about 100 units installed has asked for bids on 100 more.

Operators are showing a preference for hot-water circulating systems to achieve the down-hole heat. There are two reasons for this: Lower initial investment and cheaper operating costs.

About 125 wells, however, are electrically heated. Most of these are deeper wells (up to 4,000 ft.), where the electrical heaters are more economical. They avoid up-the-hole heat losses encountered when circulating-type heaters are used in deep wells.

What heat does . . . Why heat stimulates production in a well is still a controversial subject.

Engineers generally agree that the viscosity-temperature relationship of the crude is the most important factor involved. Some, however, think the increased output is due solely to improved pump efficiency. Others believe heating removes waxes and asphaltic deposits on the sand face and in liner perforations and thus increases flow of oil into the well bore.

The results of down-hole heating vary widely. In many instances output of small wells has doubled or trebled. In other cases wells which should have bounced back failed to do so. Just what causes this variance has not been fully discovered. The only sure way of determining if heat will work appears to be to install a heater.

The payout . . . Average sustained increase in oil production where heat was beneficial has been in the order of 10 bbl. daily. Bottom-hole heating thus is adding 6,000 bbl. daily to the state's output.

Installed cost of single-well heaters is approximately $3,000. Average operating cost, with gas valued at 30 cents per M.c.f. and electricity at 1 cent per kw.-hr., is about $2 per day. Thus the average installation must increase production by 5 bbl. daily to show a reasonable payout.

The record increase in production is believed held by a well of Intex Oil Co. in Placerita field. When heat was applied to the 3-year-old well in 1952, its oil output was down to 20 bbl. daily. It immediately rose to 76 bbl. daily. Continuously heated for the past 5 years, the well has produced 40,000 bbl. additional oil.

Bulk of the heaters are used in stripper wells in San Joaquin Valley area. In a few fields they are converting noncommercial new wells into profitable producers, however.

At Yorba Linda field near Los Angeles the heaters are making development of a shallow, low-gravity pool feasible. In Cymric field, west side San Joaquin Valley, some new wells have an initial production of about 5 bbl. daily. Unheated, they would be noncommercial. Heated, their oil output increases to 25 bbl. daily. No decline is evident in two wells which have been heated for more than 2 years.

Premium Octanes Up, Regular Steady

PREMIUM gasoline moved up 0.3 of an octane number in the first quarter of this year, but the over-all average for regular did not change, according to the latest Du Pont survey.

The weighted average of samples of premium gasoline from 53 areas was 97.3 octane in April compared with 97.0 at the first of the year. The April average for regular was 90.0, unchanged from January.

Over the past year, premium gained 1.3 octane numbers and regular advanced 1.0. The survey for April 1956 showed a national average of 96.0 octane for premium. Quality moved up to 96.5 octane in July, to 96.8 in October, and 97.0 by the end of the year. The first-quarter increase of 0.3 octane resulted in the April average of 97.3.

Regular gasoline has been improved by one number in the past year, with half of the gain in the past 6 months.

The small tables show the shifts in octane numbers in the past 2 years. The current study shows 15 cities or areas with a premium average of 98 or better and 11 others in the 97-97.9 group. Two years ago there were no cities with premium averaging as high as 97 octane.

The shift over the past year has been characterized by the movement out of the 94 and 95-octane groups with the increases showing up at the top of the scale.

For regular gasoline, more of the growth has been from the low part of the scale toward the center but with some gains at the top. The number of cities in the 86-86.9 octane group gained. Also, five more cities moved into the 90-and-over group.

The big table has been changed slightly this time to show the range in octane by individual samples.

The second columns under both premium and regular show the averages for the cities from the April survey. The third columns show the octane value of the highest sample tested in each city or area.

SHIFTS IN OCTANE RATINGS
(Cities per octane group)

Premium

Octane group—	Apr. 1955	Apr. 1956	Jan. 1957	Apr. 1957
98 Research and over	..	..	6	15
97-97.9	..	8	20	11
96-96.9	13	14	14	13
95-95.9	4	11	7	8
94-94.9	9	11	3	4
93-93.9	8	1	1	..
92-92.9	7	3	2	2
Below 92	7	2	..	..
Total tested	48	50	53	53

Regular

92 Research and over	..	2	8	7
91-91.9	..	5	7	7
90-90.9	3	3	2	4
89-89.9	7	11	11	10
88-88.9	4	5	9	10
87-87.9	7	3	6	8
86-86.9	4	13	9	5
Below 86	23	8	1	2
Total tested	48	50	53	53

Here's What Du Pont Found in Latest Survey

(Octane numbers are by Research method, arithmetic averages by cities)

	PREMIUM				REGULAR			
	Octane number			TEL cont. cc./gal.	Octane number			TEL cont. cc./gal.
	April 1956	April* 1957	April† 1957	April 1957	April 1956	April* 1957	April† 1957	April 1957
Aberdeen	94.0	96.0	96.5	2.29	86.1	88.1	89.1	1.69
Albuquerque	....	96.3	97.3	2.59	....	86.8	88.6	2.37
Amarillo	96.2	96.9	97.2	2.47	87.6	88.7	89.6	2.25
Atlanta	96.8	98.2	99.4	2.37	89.7	89.7	90.9	2.28
Bakersfield	95.1	96.1	97.3	2.90	85.8	86.5	88.0	2.60
Baltimore	97.0	98.4	100.0	2.35	91.7	92.3	94.1	2.19
Boise	....	96.4	96.9	2.27	....	86.9	87.9	1.72
Boston	96.6	98.3	99.4	2.37	92.2	92.9	94.3	2.19
Calgary	90.7	92.7	92.9	2.56	84.0	86.6	86.8	2.38
Casper	92.5	94.8	95.3	2.34	85.2	87.0	87.6	1.96
Charlotte	96.8	98.4	100.0	2.35	89.8	90.0	90.8	2.33
Chicago	95.2	97.2	97.8	2.48	88.9	91.1	92.2	2.31
Cincinnati	95.7	97.6	99.0	2.62	90.5	91.2	93.6	1.98
Cleveland	95.7	98.1	99.0	2.67	91.3	91.5	93.6	2.25
Columbus	96.0	98.4	99.3	2.76	90.7	91.4	93.3	2.32
Corpus Christi	97.2	98.6	99.3	2.85	88.4	89.1	90.4	2.49
Dallas—Fort Worth	97.2	98.1	99.2	2.70	88.0	88.9	90.9	2.21
Davenport	94.2	95.5	95.8	2.49	87.0	88.9	90.9	1.90
Denver	92.5	94.1	95.1	2.06	85.8	85.9	86.9	1.60
Des Moines	94.1	95.6	96.3	2.20	86.4	88.0	88.6	2.14
Detroit	95.9	....	....	....	90.7	....	....	....
Edmonton	91.2	92.6	93.2	1.69	84.3	86.5	87.5	1.69
El Paso	95.6	96.7	97.8	2.50	86.0	87.5	88.4	2.21
Great Falls—Billings	94.4	94.4	94.8	1.73	86.4	87.8	89.1	1.69
Houston	97.5	98.4	100.9	2.70	89.0	89.7	90.8	2.11
Indianapolis	96.0	97.9	98.7	2.86	89.6	90.9	91.1	2.15
Jacksonville	96.7	98.1	99.5	2.36	91.1	91.4	94.3	2.12
Kansas City	94.4	96.4	97.7	2.48	86.8	88.0	88.4	1.88
Little Rock	97.5	98.2	99.2	2.64	89.0	89.1	89.3	2.72
Los Angeles	96.0	97.2	98.1	2.61	86.1	87.0	90.0	1.37
Louisville	96.4	97.5	99.1	2.68	89.5	89.3	90.0	1.95
Memphis	97.0	97.9	98.7	2.61	89.5	89.4	90.2	2.22
Milwaukee	95.1	97.2	98.2	2.66	89.0	90.9	91.6	2.39
Minneapolis	94.7	96.3	97.7	2.44	86.5	88.4	90.2	1.51
Montreal	95.1	96.0	96.9	1.97	89.5	91.3	94.1	1.28
Nashville	97.4	98.1	99.2	2.78	89.2	89.2	89.9	2.25
New Orleans	96.7	97.9	99.2	2.78	88.8	89.0	90.5	2.50
New York	96.7	97.8	99.1	2.29	92.0	92.6	93.4	1.84
Norfolk	....	98.1	99.3	2.43	....	92.7	94.3	2.30
Omaha	94.3	95.5	95.8	2.35	85.9	87.8	88.9	2.17
Philadelphia	96.4	97.8	99.4	2.31	91.6	92.2	94.2	1.83
Pittsburgh	96.5	97.8	99.3	2.32	91.9	92.5	94.1	2.51
St. Louis	94.6	95.9	96.5	2.40	86.8	90.3	91.2	2.26
Salt Lake City	92.3	94.3	94.9	1.95	82.2	84.4	86.4	1.76
San Francisco	96.6	96.9	98.0	2.37	86.4	87.4	88.8	1.25
Seattle	95.8	96.5	97.1	1.90	86.6	88.0	90.1	1.32
Shreveport	97.1	98.3	99.3	2.77	88.8	89.1	90.0	2.53
Spokane	95.8	96.6	97.1	1.77	86.4	87.7	88.9	1.31
Syracuse	....	98.1	99.4	2.20	....	92.4	94.5	1.72
Toronto	95.1	96.2	97.2	2.21	89.2	91.3	94.2	1.33
Tulsa—Oklahoma City	94.6	95.9	97.5	2.45	86.6	88.0	89.3	2.05
Vancouver	94.5	95.9	96.3	1.62	85.5	88.6	88.8	1.40
Wichita	94.2	95.8	97.1	2.59	86.6	87.7	88.6	2.26
Winnipeg	93.8	95.4	96.1	2.26	87.2	89.0	89.6	1.12

*City averages. †Highest sample tested in city.

Ratable Take Upheld

● Texas court ruling places state rules over federal when it comes to conservation. But FPC not expected to challenge it now since reserves, average take unchanged

DALLAS.—Texas producers are viewing with mixed emotions an appeals court decision in Austin reaffirming a ratable-gas-take order of the Texas Railroad Commission.

This order, issued last November, required Permian Basin Pipeline Co. to take gas ratably from all wells in Puckett-Ellenburger field of Pecos County, West Texas.

Nearly all the independents and some larger operators are joyful over the court action, regarding it as a strong prop for ratable take and correlative rights.

Legal talent for several large producers, however, feels that the decision may prove costly to the industry in that it permits the Texas Railroad Commission to break a private contract between producer and pipeline. This, they feel, could set a dangerous pattern.

The pipelines, as might be expected, view the decision with dismay. Pipelines feel that breaking long-term contract could get them in trouble with the Federal Power Commission. That agency conventionally requires proof of adequate gas supply via 20-year contracts prior to approving a line.

The situation . . . The ruling by the Third Court of Civil Appeals reversed a January decision of Judge Charles O. Betts of the Ninety-eighth District Court in favor of Permian and Phillips Petroleum Co.

Principals in the case along with the commission and Permian were Phillips and Atlantic Refining Co. *(The Oil and Gas Journal, November 12, 1956, page 141).*

And the key to the somewhat unusual situation was a plant operated by Permian to take objectionable carbon dioxide out of the Puckett field gas.

Phillips, which discovered the field, owned 12 of the field's 13 wells. The thirteenth was completed later by Houston Oil Co. and taken over last summer by Atlantic when it absorbed the Houston Oil properties.

The basic problem is that the carbon-dioxide plant isn't large enough to handle all gas which the field could produce under its allowable.

Permian signed a contract with Phillips to take all of Phillips' allowable gas output. Permian later signed a secondary contract with Houston to take as much gas from its well as it had remaining plant capacity after taking all of Phillips' gas.

The result was that the Houston well was able to produce only a small part of its allowable. It piled up under production under the state regulatory system while the Phillips' wells became overproduced an equal amount.

When Atlantic took over the Houston well, it took the case to the commission for relief. It charged it wasn't getting its fair share of field demand as guaranteed by Texas statutes and that gas was being drained from under its lease. The commission agreed.

The commission ordered Permian to take gas ratably from each well in the field. It decided also to allow Atlantic to produce over the allowable of its well to make up part of the underproduction at the expense of the Phillips allowables.

The District Court issued an injunction prohibiting the commission from enforcing this order. It sided with Phillips and Permian that the order was invalid. Grounds were that Permian's take of gas from Phillips was by private contract and that the CO_2 plant was a lease facility, not a public utility which must be apportioned among producers in the field.

What new ruling does . . . The Appeals Court held that Judge Betts erred.

It said that the commission order was adopted to bring about ratable taking or purchasing of gas by a common purchaser and thus was valid.

The contracts between Permian and Phillips and Atlantic, it said, are not valid if they act to relieve Permian of its duty to purchase ratably.

The court set aside arguments of Phillips and Permian that the commission order interferes with federal jurisdiction (FPC) or interstate commerce.

Thus the court has, in effect, said that valid state conservation regulations supersede federal rules as set forth by FPC where the two conflict.

How will the FPC feel about this? It likely won't get very excited about this case since neither Permian Basin's reserves or daily take situations in Puckett appear to have changed. The pipeline still has the reserves and is still taking just as much gas though amounts from the two producers will be varied.

Too, the agency currently is very busy with other problems. And even if FPC did want to do something, it might not be able to.

Experts on gas law are becoming convinced that, even with the added powers FPC has gained in the past few years, state conservation powers will win out in any court contest.

They point out that in a sense FPC recognizes this in that it continues to approve producer-pipeline reserves contracts containing a clause which makes terms of the contract subject to conservation orders of the state.

FPC Red Tape Getting Shorter

WASHINGTON.—The Federal Power Commission is smoothing the path to its door, but it's still rocky.

The FPC in the past has required an original and 14 copies of several types of natural-gas applications. Experience has shown that's more than is needed.

In the future it will ask for only eight copies of applications for certificates or authorizations to export or import gas. Only 10 copies will be required on permits covering facilities at international boundaries for the export or import of gas.

Tough Bit Tested

New English turbodrill may mean faster drilling

DALLAS.—A new drill bit tough enough to stand up well under the rigors of turbodrilling should be fully developed within a few months.

This statement was made here last week by H. A. Herzig, director of manufacturing for Security Rock Bits, Ltd., of Manchester, England, a subsidiary of Dresser Industries, Inc.

Herzig said his firm is developing the bit. The company is owned 60 per cent by Dresser and 40 per cent by English Steel Corp.

Recent tests of the Dresser turbodrill in West Texas have shown that it cuts hard rock formations much faster than the rotary method, but that the conventional rock bits don't drill as much hole per bit with turbodrill.

Herzig said the bit under development in England "will be made of the best steel known to man."

He and Frederick Pickworth, chairman of English Steel, are in Dallas for conferences with Dresser executives.

Little Inch Switch Eyed:

Texas Eastern Hires Neptune

SHREVEPORT.—Millard K. Neptune, a 25-year veteran of the oil business with a variety of executive experience, has been named executive vice president of the products pipeline division of Texas Eastern Transmission Corp.

Neptune will have charge of products-pipeline operations which are soon expected to include the Little Big Inch, which Texas Eastern proposes to convert from gas to products service. The Government built and used the line for products during World War II. Neptune's appointment to the newly created position reflects confidence that the Federal Power Commission will approve the conversion after arguments which will open May 9.

Orville S. Carpenter, Texas Eastern president, says he expects the Little Big Inch to be in products service by this fall.

The line, which runs from Beaumont to Moundsville, W. Va., will have a daily capacity of 235,000 bbl. A 230-mile lateral to Chicago also is planned. The 20-in. line will be the largest diameter products line in operation.

Texas Eastern now operates a 320-mile products system, purchased from Triangle Pipe Line Co.

Industry career . . . Neptune, an engineering and law graduate of the University of Oklahoma, will be returning to pipelining after 2½ years in foreign operations.

He resigned as general manager of Sahara Petroleum Co., Alexandria, Egypt, after the British-French Suez Canal invasion and resulting turmoil put a crimp in Sahara operations.

MILLARD K. NEPTUNE
. . . moves from Egypt to Louisiana.

The company was exploring Egyptian concessions held by Continental Oil Co., Cities Service Co., Ohio Oil Co., and Richfield Oil Corp.

Neptune was the first president of Platte Pipe Line Co., which operates a 20-in. crude system from Casper, Wyo., to Wood River, Ill. He headed that company for 3 years before joining Sahara in 1954.

He previously was manager of the foreign department of Continental Oil Co. and served with Phillips Petroleum Co. Neptune was assistant director of production for the Petroleum Administration for Defense during World War II and the Korean War.

His brother, F. B. Neptune, is vice president in charge of products lines for Phillips Pipe Line Co.

Owner Says "Mr. Gus" Pushed

CORPUS CHRISTI. — "Mr. Gus" didn't just fall. It was pushed.

That's the gist of a detailed report from C. G. Glasscock Drilling Co. covering the collapse of its big mobile drilling platform. The vessel toppled off the South Texas coast April 3 *(The Oil and Gas Journal, April 8, page 66)*.

According to the Glasscock report, a crane barge had been anchored upwind from the drilling platform to serve as a breakwater. The anchor chain broke and the barge "drove into the drilling platform" about 2:30 a.m. "Mr. Gus" fell about 4 hours later.

Glasscock reported that the auxiliary barge, which had been sent to help rescue the drilling vessel, "was wedged between the platform and the helicopter deck."

"This immediately caused damage to the crane barge, flooding the power room and discontinuing all power," the report continued. A tug was able to pull the barge away from the drilling platform, but the barge "was taking on water and the men aboard were transferred to a boat. . . ."

Shortly afterwards, Glasscock says, a noticeable increase in the list of "Mr. Gus" was observed. The list gradually increased until the upper hull of the drilling platform started settling into the water 40 ft. deep.

"Mr. Gus" had been listing at about 7° to 10° before two crane barges arrived. Plans called for driving two anchor pilings to stabilize the vessel while it was righted, but weather conditions slowed the procedure.

"All of the equipment had been assembled and we planned to drive the pilings on the morning of April 3," the Glasscock report stated. That was the morning the $3,500,000 vessel overturned.

The crew of "Mr. Gus" was preparing to move it to a new location when the soil gave way under one side of it, causing a list of about 1°. Pilings were driven on the low side but end bearing on the pilings was not sufficient to right the platform.

Glasscock employes estimated that the list increased to 3° or 4° within 20 minutes.

"Immediate steps were taken to lower the high side of the platform by releasing the hydraulic pressure on the jacks," the report continued. "The upper platform would not slide down on the pilings at this point due to the pilings being wedged in the drilling platform. At this point the list was increased to approximately 7°.

"Crew members became alarmed due to the rapid increase in list and immediately concentrated on waking up sleeping crew members and proceeded to abandon the platform. All personnel were removed by the time the platform had taken an approximate 10° list. The time involved from the time the first list was noticed, which was less than 1°, until all crew members were taken off was approximately 1 hour." Salvage attempts are under way.

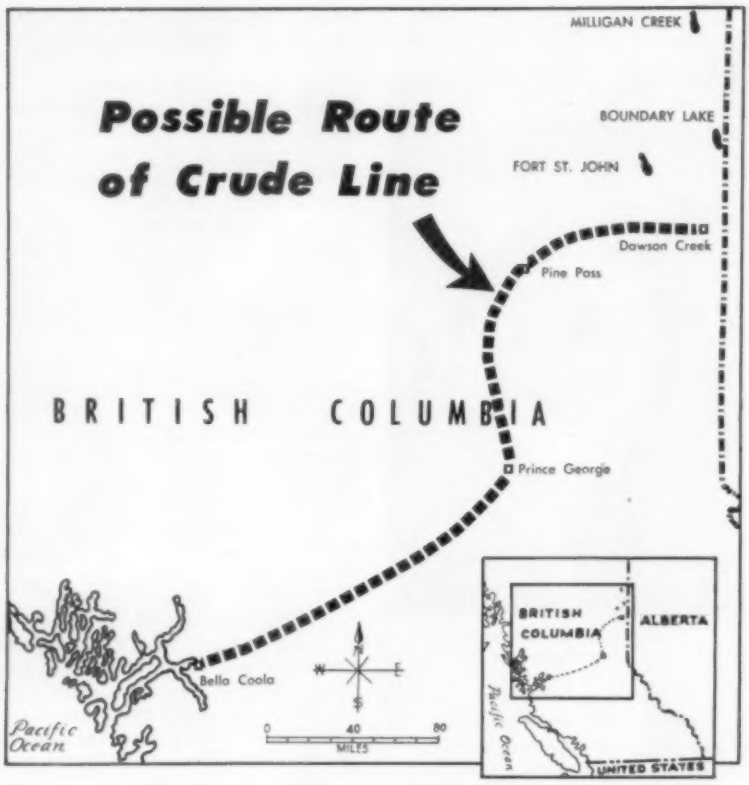
FPC Wants Sales Reports

WASHINGTON.—Independent gas producers will have to file reports on their 1956 sales and revenues. The Federal Power Commission has said it plans to set July 31 as the filing deadline.

The FPC indicated that it will ask for more information than it did last year when detailed reports were waived. But producers with interstate sales of 250 million cubic feet or less in 1956 will be asked for limited information.

Producers and other interested parties have until May 20 to submit their views in writing. The commission will then decide what type of report will be required.

Commissioner Seaborn L. Digby, who opposed the order last year, voted against requiring the reports.



Crude Line Studied

Canada Southern is banking on a big increase in British Columbia's output, which now totals only 1,200 bbl. daily

VANCOUVER.—Act Oils, Ltd., has requested a permit from the British Columbia government to build a crude pipeline from the Peace River region of northern British Columbia to tidewater at Bella Coola (see map).

Dutton - Williams Brothers, Ltd., has been retained to survey the proposed route and prepare a cost estimate for Act Oils, a subsidiary of Canada Southern Petroleums, Ltd. Phillips Petroleum Co. is now exploring 1,367,000 acres farmed out from Canada Southern.

British Columbia produces only 1,200 bbl. per day, all of it in the northeastern section. But there are almost 27,000,000 acres under lease in this area. And results of increasing exploration make British Columbia more promising as a major oil-producing province *(The Oil and Gas Journal, April 1, page 84).*

Pipeline route . . . The proposed line would start in the Dawson Creek area, cross the Rocky Mountains through Pine Pass, run south to Prince George, and then westward through coast-range passes to the sea. Bella Coola is located on the Bella Coola River, some 350 miles north of Victoria. It is considered a good site for an offshore loading terminal which could handle supertankers.

Trans Mountain pipeline, from Edmonton to Vancouver and into Washington, is the only crude line now crossing British Columbia. And it handles Alberta crude exclusively.

The route to Bella Coola is 200 miles shorter than if the pipeline were taken to Vancouver. At most, the line would be 450 miles long. It could serve Vancouver, Alaska, the Pacific Northwest, and California. The highest point to be crossed would be 2,800 ft. at Pine Pass. The route would not present the serious construction problems met by Trans Mountain, which was regarded as one of the toughest pipeline jobs in the world.

Oil fields . . . Hudson's Bay Oil & Gas Co., Ltd., and Union Oil Co. of California last month opened British Columbia's third oil field at Milligan Creek, 60 miles northeast of Fort St. John. The discovery flowed 15 bbl. of oil in ½ hour from 3,691-3,761 ft.

Although major gas reserves have been discovered in the province, oil production is only a year old. The first commercial field, Boundary Lake, was opened in February 1956. Six wells are producing about 700 bbl. daily, and the field recently got a 4-mile southwest extension.

Five oil wells in Fort St. John gas field produce roughly 500 bbl. per day.

Earlier this year a record 31 rigs were running in the province. This figure has dropped to 18 because of the spring thaws.

Alaskan Newcomers

Humble and Shell teaming up for 12,000-ft. wildcat

HOUSTON.—Humble Oil & Refining Co. and Shell Oil Co. have teamed up to explore for oil in southwestern Alaska.

The two companies have entered an agreement for joint exploration and production in the Kanatak area. Humble will begin operations immediately on a 12,000-ft. test at Cold Bay for the joint account of the two companies.

The Kanatak area is on the peninsula leading into the Aleutian chain of islands. Outside of this area, Humble and Shell plan to continue exploration individually. Extent of the acreage to be explored was not disclosed.

Humble has been conducting ground reconnaissance in Alaska for several years.

The drilling program will be the first outside the continental United States and the immediate offshore area ever conducted by Humble.

Phillips Petroleum Co. and Kerr-McGee Oil Industries, Inc., have been exploring a 1,000,000-acre block in southeastern Alaska for several years. They recently abandoned their third test there.

Another group of companies headed by Richfield Oil Corp. has recently started exploration in southern Alaska.

Oklahoma Refuses to Cut

OKLAHOMA CITY.—The Oklahoma Corporation Commission has rejected a request from crude purchasers for a 10 per cent cut in the state's May allowable production and will

retain the April allowable another month.

This will mean a daily production of 628,000 bbl. in May. It's actually a 3,000-bbl. daily increase over April due to the extra production from new wells and workover wells.

Conservation Director Massena B. Murray recommended the April allowable be retained. He noted that purchaser nominations showed a 5,399-bbl. daily drop for May and several large purchasers asked for a production cut. He said, however, that storage was in fair condition and he hoped a market can be found for the production.

New Pipe Marketed

It's made from different type polyethylene resin

NEW YORK.—A new form of polyethylene resin which is well adapted to pipe fabrication has been introduced by Allied Chemical & Dye Corp. The pipe is expected to find a market in oil and gas fields.

Pipe fabricated from the new product shows absence of stress cracking. It has high bursting strength, resistance to impact, and superior resistance to heat, chemicals, organic solvents, and hydrocarbon liquids.

Researchers of Allied Chemical & Dye claim the new resin is completely different from any polyethylene now known. It is processed at low pressure and has very high molecular weight. It now is in commercial production at the Semet-Solvay Petrochemical Division plant at Buffalo. A low molecular-weight polyethylene wax has been made at the plant for some time. It is processed from ethylene derived from converting petroleum residuals.

The polyethylene pipe is made by Orangeburg Manufacturing Co., Inc. It is available in ½ to 2-in. sizes in coils of from 100 to 400 ft. A complete line of fittings also is made.

In laboratory tests, crude oil at room temperature was pumped through a length of 1-in. Orangeburg SP plastic pipe at 115 psi. There was no evidence of leaks, swelling or weakening of the pipe.

Other tests by Allied Chemical & Dye showed the new pipe stood up without failure to 130 hours of cycling overload or water hammer which causes failure of conventional polyethylene in 11 minutes. It also has undergone 5 million flexing cycles without failure and passed over 6,000 hours in an acetic acid environment without stress cracking.

Pipeline briefs

Transcontinental Gas Pipe Line Corp. has invited bids for construction of its first offshore pipeline. The line will tap new gas reserves off the coast of Cameron Parish, Louisiana, and will extend to Transco's existing system near Lake Charles. The company recently purchased 88 billion cubic feet of offshore gas from John W. Mecom and others.

Work on the new line is expected to start about June 1. The new lateral, including the onshore portion, will be 28.5 miles long and 16 in. in diameter. Cost has been estimated at $2,436,000.

Gibson Crude Oil Purchasing Co. has received Alberta Government permission to build a 19-mile, 6-in. crude line from Bellshill Lake, east-central Alberta, to the Hardisty terminal of Interprovincial pipeline. The pipeline outlet, with 2,000-bbl. daily capacity, will permit a wellhead price increase to producers of 30 cents per barrel. The line is to be started early in May and completed June 30. It will cost $580,000.

Four Corners Pipe Line Co. last week received the first pipe of an order totaling more than 600 miles of 16-in. The pipe will be used for a crude line from Utah to Los Angeles. Shell Pipe Line Corp. will build and operate the line for the six owners.

Surveys are half complete but construction contracts have not been let. The line will have initial capacity of 60,000 bbl. daily and is scheduled to start operating late this year. The system, totaling 750 miles of pipe, will have 8 and 12-in. feeder lines from Aneth and other fields in Utah and Bisti field in New Mexico.

North Carolina Natural Gas Corp., subsidiary of Colonial Natural Gas Corp., Houston, plans to start construction of its natural-gas system late this year. Pipe delivery is scheduled for the fourth quarter. There will be 630 miles of 2 to 16-in. The system should start operating late next spring or early in the summer. It will take 39,780,000 cu. ft. of gas daily from Transcontinental Gas Pipe Line Corp. near Mooresville and move it eastward across North Carolina.

Trans-Canada Pipe Lines, Ltd., has let contracts to extend its system from Winnipeg to the Ontario border this year. Majestic Contractors, Ltd., will lay the 82 miles of 30-in. to Port Arthur, Ont., to be completed by October 15. Majestic also has the contract to test the 574-mile 34-in. line which will be completed from Alberta to Winnipeg this summer.

Westspur Pipe Line Co. is expanding its crude-gathering system in southeastern Saskatchewan. Majestic Contractors, Ltd., has the contract to lay 20 miles of 12-in. from Alida to the Carnduff-Glen Ewen area to serve Cantal, Hastings, Florence, Carnduff, and Glen-Ewen fields. The expansion also includes 34 miles of 4, 6, and 8-in. Westspur also proposes to loop its trunk line with 75 miles of 16-in. from Steelman, Sask., to Cromer, Man.

Also for Pipeliners . . .

Gas pipelines may face some problems in the future as result of a Texas appeals court decision upholding ratable take. The ruling will permit the Railroad Commission to break a contract between a producer and pipeline (P. 108) . . . Texas Eastern hires Millard Neptune to head products division (P. 109) . . . Crude outlet for northern British Columbia is under study (P. 110) . . . Allied Chemical has a new polyethylene resin pipe (P. 111) . . . P.G.&E. plans outlet for northern California gas (P. 114) . . . Royalty owners claim California's Rio Vista gas field is under the thumb of a monopoly (P. 115) . . . Harris-O'Hara gas bill will start on rocky road through Congress next week (P. 116) . . . T.G.T. gets temporary permit to buy offshore gas (P. 116) . . . Crude line from Venezuela's Barinas-Apure basin almost ready (P. 118) . . . Products line to link refinery with inland markets planned in Chile (P. 119) . . .

PLUS THESE TECHNICAL FEATURES: Phillips Petroleum has been pipelining propane for 10 years. Here's how the volatile material is handled (P. 130) . . . and Pipeline Patrol's construction report (P. 211).

Kansans Fear New Costs

● **Already hit by a 1 per cent severance tax, oil men are wondering what four new antipollution laws will cost them**

WICHITA, Kans.—Oil men in Kansas are faced with higher operating costs as a result of four new antipollution laws.

The state legislature passed the bills in the waning days of the 1957 session, giving state agencies more say-so about surface casing, salt-water ponds, and salt-water disposal wells.

The legislature's move to protect fresh water and "usable" water in drought-conscious Kansas made independent operators wonder just how much it would cost them. Already they've been stung by a 1 per cent severance tax by the 1957 legislature.

Members of the Kansas Independent Oil and Gas Association met in a special session here last week to study the new pollution-prevention bills. Most of the new rules will become effective July 1.

In eastern Kansas, a new organization is being formed to "keep the oil operators informed" of the effects of the new laws. The new group is called the Eastern Kansas Oil and Gas Association.

K.I.O.G.A. officials estimate the new antipollution laws could cost the oil industry an additional $10 to $15 million annually in surface pipe and salt-water facilities.

The new rules would:

... **Require surface casing** to protect "usable" as well as "fresh" water. Usable is defined as water containing not more than 5,000 parts per million chlorides. Fresh water is defined as containing 500 parts per million chlorides.

The Kansas Corporation Commission will determine the amount of surface casing for each well after the oil operator has filed intention to drill.

... **Prohibit salt-water storage** in open ponds without permission from the state board of health. The board can deny permission if the pond is likely to cause pollution.

... **Establish a minimum depth** for salt-water disposal wells.

In addition to the corporation commission and the health board, the new laws give regulatory authority to the state water resources board and the state geological survey.

What it means . . . One Kansas oil man said the new laws could be interpreted as requiring a minimum of 200 ft. of surface casing at new wells in eastern Kansas, where much of the activity is secondary recovery. In some parts of Kansas, the practice is to set very little surface casing at wells.

A spokesman for K.I.O.G.A. said most of eastern Kansas' 15,000 to 20,000 wells are connected to salt-water ponds. Many of these ponds hold salt water for later reinjection into wells to maintain pressure.

Alternatives to open ponds would be steel containers or disposal wells. This would be costly to many operators since an estimated 12,000 wells in eastern Kansas produce less than 1 bbl. of oil daily.

The law which requires minimum depths for salt-water disposal wells has been interpreted as meaning 1,000 ft. in eastern Kansas, and below the Dakota sandstone in western Kansas. The Dakota is an aquifer which is found as deep as 2,000 ft. in parts of western Kansas.

Kenneth Keas of Keas Drilling Co., Chanute, president of the new eastern Kansas organization, said that some operators with "four or five producing wells, making about 5 or 10 bbl. per day will plug them and forget about it rather than drill deep salt-water disposal wells."

Proponents of the bill claim that salt water has been damaging irrigation facilities and fresh water for human consumption and livestock.

Kansas has 37,095 producers averaging 9.2 bbl. daily per well. Output for the state was about 340,000 bbl. daily the first quarter of this year.

Severance tax . . . Gov. George Docking supported and signed the antipollution bills as well as the 1 per cent severance tax bill.

The new severance tax will cost Kansas producers and royalty owners an estimated $3 to $4 million annually.

As one independent operator put it: "We can live with the new severance tax, but there are many of us who can't live with the new antipollution bills."

In tiff over grand jury probe:

Flurry Quits Antitrust Post

WASHINGTON. — The grand jury investigation of the oil industry at Alexandria, Va., was labeled a fishing expedition last week by a Justice Department official who refused to have anything further to do with it.

Horace L. Flurry, veteran antitrust division official originally in charge of the investigation, resigned from the Justice Department as a result of differences with his superiors over how it should be handled.

Flurry charged that his plan to call only 22 witnesses before the grand jury was changed and 55 were subpenaed. This gave an impression that the Government is on a fishing trip, he charged.

The grand jury is investigating possible collusion among oil companies in the fixing of prices. It was called last February just before Asst. Atty. Gen. Victor R. Hansen, head of the antitrust division, was due to testify before the O'Mahoney subcommittee investigating the oil lift.

The grand jury started its inquiry March 4 on a part-time basis. Since then it has met for a number of 2 and 3-day sessions, hearing a few witnesses at a time. No top officials of any companies have yet been questioned.

Flurry joined the antitrust division in August 1941. He headed three of its field offices and has successfully prosecuted a number of antitrust cases.

His resignation was accepted "with regret" by Hansen, who backed up the officials with whom Flurry differed.

"They believed that a very thorough, complete investigation should be made of the oil companies involved, whereas you believed a more limited investigation was desirable," Hanson said in a letter to Flurry.

"Also," the letter continued, "your superiors believed that the procedures you thought desirable might well have been unproductive and would certainly have been cumbersome and ponderous.

"Moreover, the course of proceedings in this case, like any significant antitrust investigation, had been considered at some length by me, and I am convinced that the investigation is now proceeding in the way best calculated to get the facts quickly."

Webber Wins Hanlon Award

HOUSTON. — The Hanlon Award, highest honor in the natural-gasoline industry and one of petroleum's ranking awards, was conferred last week on Charles E. Webber, technical adviser to John G. Pew, production vice president, Sun Oil Co. of Philadelphia.

Webber is the twenty-first recipient of the award, which is made annually by the Natural Gasoline Association of America for outstanding service and leadership.

Presentation was made by N.G.A.A. president A. H. Weil, United Gas Pipe Line Co., Shreveport, at the association's thirty-sixth annual convention here. The citation read in part:

"In making this presentation, we are specifically recognizing his valuable service to the industry in times of national crisis, his personal contributions to the technology of natural-gasoline operations, and his stimulating and constructive leadership in cooperative group activities which speeded progress toward desired and greatly needed technical objectives."

A native of Stillwater, Okla., Webber obtained a chemical-engineering education at Louisiana State University and joined Humble Oil & Refining Co.'s technical staff in 1934. While with Humble he did the experimental work which led to the publication of his paper, "Equilibrium Constants for Hydrocarbons in Absorption Oil," which is still useful in the design of high-pressure absorbers.

CHARLES E. WEBBER
. . . In a time of crisis, leadership.

Washington service . . . In June 1942 he went to Washington where he served on the staff of the natural-gasoline division of the Petroleum Administration for War. At the close of the war he became assistant to the late James E. Pew, Sun Oil Co., Philadelphia, in the operation of Sun's natural-gas division.

Webber was in Washington again in 1951 as director of the natural-gas production and processing division of the Petroleum Administration for Defense. The following year he returned to Philadelphia. But he still commutes to Washington as a member of the Military Petroleum Advisory Board. He assumed his present position in 1955.

Donor of the Hanlon Award is E. I. Hanlon, chairman of the board, National Bank of Tulsa, and a pioneer of the natural-gasoline industry.

Louisiana Coast Being Mapped

WASHINGTON. — The Supreme Court may decide soon whether Louisiana has a 3-mile or 3-league boundary in the Gulf of Mexico.

But whichever way the decision goes it will not settle another big question—the line from which the boundary is to be figured.

Louisiana contends it should be measured from the "Coast Guard line," which runs outside of some offshore islands. That is not acceptable to the federal Government. It holds the line should be measured from the low-water mark on the mainland and around Louisiana's islands.

As a first step toward resolving the dispute, Louisiana and the Interior Department's Bureau of Land Management are sharing the cost of making a detailed map of the area.

The mapping is being done by the Coast and Geodetic Survey, through aerial photographs taken along the low-water line.

Some of the area was mapped in this way in 1953, with oil companies footing the bill. The gaps in that survey are now being filled in. The aerial photographs will cover the whole coast except the delta area and Atchafalaya Bay.

—— *Industry* briefs

Spooner Mines & Oils, Ltd., of Toronto, will drill for natural gas off the north shore of Lake Erie in the vicinity of the Mersea-Kingsville gas fields. The company has one concession in the lake and is completing arrangements for two others.

Two affiliated Dallas drilling companies have been merged into Fleeger Drilling, Inc., with Thomas H. Fleeger as president. The merged firms are Star-State Drilling Co. and Fleeger-Riley Drilling Co. Headquarters will remain in Dallas.

Graham-Paige Corp. has sold United Supply & Manufacturing Co. of Tulsa to Botany Mills, Inc., for $5 million. Payment includes 225,000 shares of Botany's common stock. United's sales last year totaled $23,264,449.

H. B. Gutelius, who founded United, will continue as the company's chairman, and H. B. Gutelius, Jr., will continue as president. The only change in the personnel setup will be the addition of two members to the seven-member board. No change in operations is planned.

Louisiana's production allowable has been dropped to 883,318 bbl. for May. This is 36,095 bbl. under the April allowable and more than 100,000 bbl. under the state's peak production rate during the emergency oil lift to Europe.

North Dakota's crude-oil allowable for May will be 36,291 bbl. a day, about 10,000 bbl. daily over the April figure. The State Industrial Commission limited April's output to 26,962 bbl. daily because of the annual clean-up and maintenance shutdown of the Mandan refinery of Standard Oil Co. (Ind.)

The second Cuban Petroleum Congress, scheduled for May, has been postponed. Dr. Alberto Diaz Masvidal, president of the organizing committee, said a new date for the industry-wide meeting will be announced shortly.

California Research Corp. is expanding its laboratory facilities. Construction is under way at a $500,000 addition to the La Habra research center.

The proposed two-story building will house the petrology and well-completion laboratories, and a computing center for theoretical and experimental data.

Shut-in Gas Gets Relief

Two pipeline projects expected to boost development of Beehive Bend-Willows gas field in northern California

SACRAMENTO, Calif.—Two pipeline projects of Pacific Gas & Electric Co. promise to give Beehive Bend-Willows gas field in northern California a chance to live up to its advance billing as one of the state's potentially great fields.

One project has started. The other is in the planning stage. Together they will give the field new outlets both north and south (see map).

Natural-gas operators have considered the field 83 miles north of here as a major gas reserve, possibly some day rivaling large Rio Vista field, currently largest in the state. Until now, however, an inadequate gathering system and major transmission line to markets have restricted full development.

The two pipelines which may change this situation are:

. . . An 83-mile pipeline and gathering system from Beehive Bend-Willows to Sacramento. Work already has started on this route by crews of Engineers Limited Pipeline Co.

. . . A proposed 173-mile line from Corning to Humboldt County in extreme northern California. Corning is 30 miles north of Beehive Bend. The two fields already are connected by a pipeline.

The Beehive Bend-Sacramento line will have 37 miles of 20-in. pipe, 37 miles of 18-in., and the balance 16-in. It will supplement an existing line of 8 to 16-in. diameter which meanders between Beehive Bend and Sacramento. The project is scheduled for completion this summer.

The Humboldt-Corning project will have 12-in. pipe throughout with a daily capacity of 21,000 M.c.f. Work probably will start this summer, and the job will be completed within 2 years. The new line will open a market for Beehive Bend-Willows gas in the Eureka area. This region has been supplied by nearly depleted Tompkins Hills gas field and by manufactured gas.

Status of development . . . Engineers estimate present proved reserves of Beehive Bend-Willows at more than 100 billion cubic feet. The area is considered about half developed.

Here's the brief story of that development:

Ohio Oil Co. discovered Willows field in 1937. Production was from shallow Cretaceous sand at 2,237-45 ft. The few wells drilled in the shallow pay quickly declined. Sunray Mid-Continent Oil Co. then brought in Beehive Bend field in 1953. The discovery well produced at 3,653-65 ft. Later the same year Sunray Mid-Continent extended production with another discovery at 5,000 ft.

Subsequent drilling has connected the two fields. It also revealed such tricky geology that every test now is considered a wildcat. The Cretaceous sands appear and disappear over the field without any regular pattern.

This has resulted in a drilling ratio of one dry hole for every two producers. Development has been on a 160-acre spacing. However, within the last few years there have been 39 successful completions with production being expanded to 40 million cubic feet daily. Eighteen of the wells are shut in because of no pipeline connections.

General Petroleum Corp. and a combine of Humble Oil & Refining Co. and Honolulu Oil Corp. are attempting to extend the field which now has grown to 4,000 productive acres. General Petroleum has two rigs working and Humble-Honolulu one.

The payoff . . . Operators in Beehive Bend-Willows expect development to spurt with the prospect of two pipeline outlets.

Actually California-produced gas has a ready market at prices which give it a competitive advantage over supplies brought in from out of state. But apparently uncertainty over reserves of the northern California field previously had made pipeline investors shy away from putting in sufficient lines.

Dry gas at the wellhead in California now brings between 25 and 28 cents per M.c.f. The vast majority of this gas is consumed within 100 miles of the producing wells. This makes transportation a small factor in total cost to the buying utility. Transmission costs amount to a cent or two per M.c.f. in 90 per cent of the cases.

Imported gas delivered to the San Francisco area costs the utility 31.9 cents per M.c.f. and 27.5 cents per M.c.f. in the Los Angeles region. This cost advantage for California gas makes it highly coveted by local utilities. These utilities currently are importing more than 1.6 billion cubic feet daily. This will be increased to 2 billion cubic feet next year. The rising tide of imports reflects the inability of California gas fields to meet the state's tremendous demand.

The gas picture . . . The main source of California's natural gas are fields in 10 counties in the Sacramento Valley of north-central California.

These 10 counties accounted for 120 billion cubic feet of the state's 141 billion cubic feet of dry-gas production in 1956. Casinghead-gas production provided another 345 billion cubic feet last year. But this production has declined in past years along with the state's crude output. This trend is expected to continue.

The trickery of establishing California's natural-gas reserves is shown in the dry-hole ratio experienced by drillers. Last year operators drilled 54 dry holes and 35 producers in the search for natural gas in the 10 Sacramento Valley counties. Glenn County, which encompasses Beehive Bend-Willows field, paced this activity with 28 tests, 14 of them producers.

Monoply Charged

Rio Vista royalty owners file $150 million gas suit

SAN FRANCISCO.—A suit charging monopoly in the California gas industry and asking damages of $150 million has been filed in federal District Court here.

Owners of mineral rights in the Rio Vista natural-gas field in Solano County filed the suit against nine oil and gas companies. The plaintiffs contended that importing 77 per cent of the gas used and marketed in California discourages development in the state. They also charged the defendants are monopolizing natural-gas resources and pipeline facilities in the west.

The suit more specifically claimed that El Paso Natural Gas Co. and Pacific Northwest Pipeline Co. combined with Pacific Gas & Electric Co. to monopolize purchase of gas in northern California, Nevada, Arizona, Colorado, Utah, Wyoming, Idaho, and Oregon. This has resulted in depressed sales of Rio Vista gas, the complaint stated.

The suit stated the Rio Vista field includes 25,000 acres and is the largest gas property in California. Reserves are valued at $400 million. Plaintiffs asked $50 million, trebled under antitrust law provisions to $150 million. Plaintiffs are William E. Elliott and his wife, Madeline O'Larte, Rita Stomer, Lester, Theresa, Janet and William X. Callaghan, Jr., and 15 persons unnamed.

Defendants besides El Paso Natural, Pacific Northwest and Pacific Gas & Electric are Amerada Petroleum Corp., Standard Oil Co. of California, Superior Oil Co., The Texas Co., Monterey Oil Co., and Natural Gas Corp.

Processing Briefs

An explosion at the Beaumont refinery of Magnolia Petroleum Co. last week killed two employes. Dead are Edmund A. Vaughan, still operator foreman, and Thomas B. Hensley, an assistant operator.

The explosion occurred at a sweetening unit in natural-gasoline service. It was followed by a blaze which could be seen for miles. The damaged unit was expected to be out of operation about 2 weeks.

National Distillers Products Corp. is changing its name to National Distillers & Chemical Corp. Chemical activities of the firm will continue under U. S. Industrial Chemicals Co., a division, and National Petro-Chemicals Corp., in which it owns 60 per cent. Chemicals last year accounted for 34 per cent of the corporation's operating profits before taxes, interest, and minority interest.

Dow Chemical Co. has started construction of a second synthetic glycerin plant at Freeport, Tex. Propylene and chlorine will be used as raw materials in the new unit, scheduled to be completed next March. Capacity of the plant was not announced. But Dr. A. P. Beutel, Texas division general manager, said the new unit will double the company's present glycerin capacity.

Sinclair Oil & Gas Co. has installed a new dehydration unit at its natural-gasoline plant No. 20 in San Patricio County near Corpus Christi, Tex. The unit will handle 12,000 M.c.f. daily at 1,000 psi. pressure.

The company is now installing a 1,100-hp. compressor unit to boost the plant's absorber residue gas from 160 to 1,000 psi. for delivery to Texas Eastern Transmission Corp. The 21,000-M.c.f. plant gathers gas from the East White Point and Midway fields.

A new gas purification plant at Humble Oil & Refining Co.'s Baytown, Tex., refinery will be installed by Girdler Co., Louisville, Ky. It will include three complete purification trains to provide maximum flexibility and on-stream factor. The gas streams, totaling 2,770,000 cu. ft. per hour, will be treated with a solution of diethanolamine and water.

The project was subcontracted to Girdler by M. W. Kellogg Co., which will erect the unit in connection with other work Kellogg is doing at the refinery. Girdler is a division of National Cylinder Gas Co.

The world's largest plant for recovering elemental sulfur from refinery gases has gone on stream at Tidewater Oil Co.'s new Delaware refinery. Designed by Ralph M. Parsons Co. and built by C. F. Braun & Co., it converts hydrogen sulfide to high purity sulfur. Capacity of the unit is rated at 340 tons of sulfur per day, but its production will vary with the percentage of sour crudes processed at the 130,000-bbl. per day refinery.

Also for Refiners . . .

Mobilization Director Gordon Gray has ruled imports are excessive, and President Eisenhower has ordered an investigation (P. 99) . . . The O.C.A.W. union leadership is facing a critical decision soon: Accept the 5 per cent wage increases generally being offered or call a strike (P. 102) . . . Refiners and auto makers are approaching a head-on collision on gasoline volatility. Some compromises by both may be due (P. 104) . . . Premium gasoline is up 0.3 of an octane number and regular remained steady during first quarter, Du Pont survey shows (P. 107) . . . Charles E. Webber of Sun Oil Co. has been given Hanlon Award by the N.G.A.A. (P. 113) . . . Iraq Petroleum Co., Ltd., and the Iraqi Government have agreed to cut sales discount on crude from 2 to 1 per cent (P. 119) . . .

PLUS THESE TECHNICAL FEATURES: Roundup report on gas dehydrators (P. 123) . . . Instrumentation advances in field plants (P. 135) . . . Data for ethanolamines aid in design and operation of gas-treating plants (P. 139) . . . Vapor-phase chromatography in field plants (P. 146) . . . Annual survey of processing plants (P. 152) . . . Salvaging wasted power in gasoline plants (P. 177) . . . Calculating lean-oil vaporization loss (P. 180) . . . Wellhead dehydrators in the San Juan basin (P. 188) . . . On The Job . . . In the Fields (P. 191) . . . How much automation in process plants? (P. 197) . . . The Foreman's Page (P. 203) . . . and Refinery Construction Report (P. 205).

Gas Bill Hearings Set

Harris plans timetable to get measure out of committee quickly; if he succeeds, clear sailing is seen for the bill

WASHINGTON. — The Harris-O'Hara gas bill will start on the long road through Congress next week.

Chairman Oren Harris of the House commerce committee, and one of the authors, has laid out 8 days of hearings. All interested persons will be given a chance to be heard, he said. Harris doesn't believe it will be necessary, however, to string out the hearings as long as those in 1955 on the Harris-Fulbright bill.

This is Harris' timetable: Government officials and supporters of the bill will be heard from May 7 through May 10. Opponents then will be given 4 days, from May 14 to May 17.

The lineup . . . Federal agencies having an interest in natural gas have been asked to submit their views on the bill in writing before the hearings.

These agencies include the Federal Power Commission, Interior Department, Office of Defense Mobilization, Budget Bureau, and the Treasury, Justice, and Defense departments.

All are seen as supporting the bill but may have suggestions for minor changes. The measure already has received the White House blessing. That is expected to set the tone of administration thinking.

Reports from the industry indicate that gas producers generally can be counted on to favor the bill. The pipeline companies, with one or two exceptions, are believed committed to it. Distributors are divided, but some who opposed the former bill will go along with this one.

Opposition to the bill is expected all along the line. The first signs of that came shortly after it was introduced. Senator Alexander Wiley of Wisconsin was the first to say he would fight the proposal.

But political observers believe that if the measure gets to the House floor, it will be passed. If that can be achieved quickly enough, there is a good chance the Senate will take up the bill before the end of the session. No great difficulty is expected there.

The Harris-Fulbright bill passed the Senate last year with a much better showing than it made in the House in 1955. The House accepted it by a close vote of 209 to 203. The Senate vote of approval was 53 to 38.

The outlook . . . If the Senate doesn't get to the bill this year, it will come up in the midst of 1958 precampaign jockeying.

Sixteen of the senators who voted for it last year will be up for reelection in 1958. More than half of them are from consuming rather than producing areas. Most of them are expected to hold firm in support of the bill. But there's a strong chance some who foresee strong opposition might switch to get support at home. Since the views of the eight new senators in Congress this year are not generally known, the effect of these newcomers on the lineup can't be figured.

Harris, himself, isn't predicting that the bill will go to the White House this year. Nor is he claiming there is no opposition to it within his own 33-man committee. He did say last week that "with the approval of the principles of the bill which the President has indicated, it would seem to me that the bill has more than a reasonable chance of being passed during this session of the House."

Adena Repressures

Unusual operation injects water into gas-oil contact

DENVER. — The biggest water-injection project in Colorado history is under way in Adena field of Morgan County, the leading producer in the Denver basin.

Instead of the usual method of injecting into the water formation, the Adena operation pumps water into the gas-oil contact zone of the J sand. The water layer prevents the oil from escaping into the gas cap and forces it up through the producing wells.

This system permits unlimited production of gas from a field where high gas-oil ratios have held production to an average of 14,000 to 16,000 bbl. daily. Of the field's 181 wells, 65 have been shut in for several months because of high gas-oil ratios.

The 10-year pressure-maintenance program is expected to increase Adena's production from an estimated 41,000,000 bbl. to 71,000,000 bbl., according to Arthur J. Jersin, director of the Colorado Oil and Gas Conservation Commission. Average daily production will soon be increased to nearly 20,000.

Jersin said the program, when fully developed, will inject 34,500 bbl. of water daily into 23 wells. Eight producing wells with high gas-oil ratios have been recompleted and converted to injection wells. Fifteen additional injection wells are being drilled. Injection fluid is obtained from six water wells with an average depth of 90 ft.

Adena was unitized last October with Pure Oil Co. as the operator. Principal owners are Pure, with 37 per cent; Lion Oil Co., a division of Monsanto Chemical Co., 25 per cent; and Falcon Seaboard Drilling Co. and associates, 8 per cent. The remaining 30 per cent is split between various companies and individuals.

T.G.T. Gets Permit

Temporary FPC approval covers big C.A.T.C. sale

WASHINGTON.—The largest gas reserve ever committed to one sale has been approved by the Federal Power Commission.

But the FPC has yet to pass on the price at which C.A.T.C. group may sell more than 6 trillion cubic feet of Continental Shelf gas to Tennessee Gas Transmission Co. over the next 20 years.

The commission last week granted a temporary sales certificate to the four producers in the C.A.T.C. group. At the same time it issued temporary authority to T.G.T. to build 107 miles of pipeline to connect its system to the offshore reserve. The pipeline will cost $16,315,412.

Detailed plans for what will be the world's longest offshore pipeline were released by the company earlier this month *(The Oil and Gas Journal, April 22, page 84)*.

The temporary certificates were issued because of the necessity for quick action if T.G.T. is to build its pipeline by next November 1, when gas deliveries are to start.

Rates issue . . . But the price at which the gas will be sold, set initially at 22.4 cents per 1,000 cu. ft., has been challenged by the New York Public Service Commission and three of T.G.T.'s customers.

T.G.T. will take the gas at the offshore platforms. Until November 1, 1958, it is to take 175 million cubic feet daily or four-fifths of what the wells can produce. After that, Tennessee is required to take and pay for 1 million cubic feet for every 8 billion cubic feet of recoverable gas originally in place.

The proposed initial price of 22.4 cents will hold until November 1, 1962. On that date, and every 4 years thereafter, it is to increase by 2 cents per 1,000 cu. ft.

Aramco Answers Critics

In defense of its tax policies, Aramco says 1918 revenue laws are necessary to encourage U. S. investments abroad

STUNG by the oil-critical senatorial team of O'Mahoney, Kefauver, and Douglas, one of the Middle East's oil-producing giants last week defended the tax policies which siphon its money into Saudi Arabia instead of the United States Treasury.

The senatorial team asked the U. S. Senate's finance committee to study the situation to see if Saudi Arabian income tax laws are designed to help Aramco avoid U. S. taxes *(The Oil and Gas Journal, April 22, page 85).*

A few days later Aramco issued a formal statement in New York with the straight-faced comment that its "income tax affairs have been the subject of comment in recent weeks." Aramco said it wanted to present the facts.

The company pointed out that the provision of U. S. laws which the senators are questioning has been a part of the U. S. revenue laws since 1918. Its purpose is to relieve U. S. business operating abroad from double taxation—the payment of U. S. income taxes on top of foreign income taxes.

"Foreign tax credit is necessary if American business is not to be discouraged from operations and investments abroad," Aramco said. The company points out that the same principle applies whether the business is oil or some other kind of business.

Aramco says it has paid more taxes to Saudi Arabia every year than it would have to pay to the U. S. Treasury if it had conducted the same business with the same profit in the United States. On top of this, Aramco says, Uncle Sam has collected income taxes on what was left.

How it started . . . The company admits it was exempt from Saudi Arabian income taxes at one time. Before 1950, the company paid the Arab country only royalty on its oil production. In those days the U. S. got the lion's share in the form of U. S. income taxes. Saudi Arabia complained.

Aramco said it objected to making the change, but "since the source of Aramco's profit was from Saudi Arabian oil, the chief resource of that country" as a practical solution it submitted to the Arab Government's demand in 1950 after an income tax law was enacted.

Depletion's role . . . Defending its depletion deduction, Aramco said this has been done in accordance with U. S. revenue laws in existence since 1926. Aramco said these laws "have been examined by Congress on repeated occasions since."

"This deduction has been available during all that time to United States oil producers, whether their production has been domestic or foreign. No substantial changes have been made in the law since its inception."

How U. S. benefits . . . As a parting shot, Aramco said the U. S. economy does benefit from its operations.

The United States gets the taxes levied on the dividends which Aramco pays to the stockholders of the corporations which own the company. Standard Oil Co. of California, The Texas Co., and Standard Oil Co. (N. J.) each own 30 per cent of Aramco. Ten per cent is held by Socony Mobil Oil Co., Inc.

If foreign tax credit were denied and the depletion credit were reduced, a condition of double taxation would result, Aramco says. This would clearly discourage American investments abroad and damage the U. S. economy.

To drill on new concessions . . .

. . . Kermac Entering Venezuela

ANOTHER major drilling contractor is preparing to enter Venezuela.

Kerr-McGee Oil Industries, Inc., Oklahoma City, is building two tenders for drilling in Lake Maracaibo. The firm has contracts with two combines which landed concessions in Venezuela's recent big lease sales.

Just recently Falcon Seaboard Drilling Co. of Tulsa bought the six-rig firm of Drosdat & Dotson, which was operating in Eastern Venezuela. Most of the country's contract-drilling operations have been handled in the past by Loffland Brothers Co., Delta-Gulf Drilling Co., and Santa Fe Drilling Co.

Kermac is a member of one of the operating groups for which it is to drill. This group is headed by Phillips Petroleum Co. The other combine is headed by Sun Oil Co.

The tender under contract to Sun is scheduled for delivery in mid-June. The second should be ready late in July. Both are being built by Levingston Shipbuilding Co. at Orange, Tex.

Nine crewboats and two workboats are also under construction for Venezuelan service by Kermac. The company plans to transfer its tug Senator from the Gulf of Mexico to Lake Maracaibo.

Leo LeBron, now marine superintendent for Kermac, will head the Venezuelan operation (see page 272).

Kermac was one of the pioneers of offshore work in the Gulf of Mexico and is still a leader in the area. The company also has been active abroad.

In 1949 it drilled its first foreign well—the first test on American Independent Oil Co.'s concession in the Kuwait-Saudi Arabia Neutral Zone. Kermac since then has operated in Alaska, Israel, and Cuba, and along the Gulf of Campeche in Mexico for Mexican American Independent Co.

The Mexican wells were the first drilled in Mexico by an American company after the expropriation in 1938.

No rush expected . . . The Kermac and Falcon Seaboard moves don't mean there will be a big rush of contractors into Venezuela.

The big drilling program expected as a result of new concessions will develop slowly. Little new equipment will be needed until new fields are found and development drilling gets under way.

In Lake Maracaibo, for example, three tenders already are on hand for work on new concessions, another is ready to move into the area, and two more are now en route to Venezuela. Kermac's pair of new ones will further increase the fleet.

Contractors expect few, if any, discoveries on the new concessions in the next 6 months. And they feel it will be some time after that before development drilling reaches significant proportions.

From the heavily-timbered area of Barinas . . .

. . . to the Caribbean coast at Puerto Cabello.

New Venezuelan Crude Line Almost Ready

CRUDE should start flowing this summer from the untapped Barinas-Apure basin of Venezuela to the Caribbean coast.

A 212.5-mile, 20-in. pipeline being built by Socony Mobil Oil Co. de Venezuela and Sinclair Oil & Refining Co. is 80 per cent complete. Williams Brothers, the contractor, expects to finish the job by July. It will extend from San Silvestre field, southeast of the city of Barinas, to Puerto Cabello, which is destined to become Venezuela's third major port as well as a petrochemical center.

Capacity of the line, with one pumping station at Silvestre, will be 110,000 bbl. per day. This can be increased to perhaps 170,000 bbl. per day when an intermediate station is built at Acarigua, midpoint of the line.

Besides serving fields discovered by Socony and Sinclair, the new pipeline will stimulate development of nearby concessions recently granted by the Venezuelan Government. Prospects point to a second line out of the area within a few years, perhaps following the same route.

Construction . . . The pipeline parallels the main highway into the interior except for the last 60 miles on the Barinas end.

Williams Brothers had to build its own road on this portion of the route, which is heavily timbered. The clearing job, starting last November, kept a dozen big bulldozers busy. A landing strip was cleared in the timber so that key personnel could be flown in and out.

Pipe is laid bare on concrete sleepers above ground except at rivers.

The 12 major river crossings pose a problem. Much of the route goes through an area with 100-in. annual rainfall. Even in the dry season, frequent mountain showers maintain swift currents in the streams, and quicksand fills the ditch almost as fast as it is cut.

Venezuela Reveals First Concession Prices

VENEZUELAN SUN OIL CO. and associates paid $30,106,080 for a 22,733-acre block in Lake Maracaibo, the Venezuelan Government revealed last week. The successful bid averaged $1,324 per acre.

The price was among several announced officially in Caracas as being paid in the latest awards of concessions. The announcements are coming piecemeal in the government's Gaceta Oficial.

Sun will operate the lake concession for a combine which also includes Atlantic Refining Co., Pan American Petroleum Corp., and Seaboard Oil Co. The same group paid $810,000 for a 24,710-acre concession on the Colombian border.

Other prices revealed include:

. . . King-Mill Oil Co., C.A., $9,882,000 for 24,710 acres in Block 26 Barinas, and $805,140 for 24,562 acres along Colombian border.

. . . San Jacinto Venezolano, S.A., $810,000 for 24,710 acres along the Colombian border. This company is a subsidiary of San Jacinto Petroleum Corp., Houston, and heads a group including Phillips Petroleum Co., El Paso Natural Gas Co., Sunray Mid-Continent Oil Co., and Pacific Petroleums, Inc. This group won the coveted Lake Maracaibo Block 10, but prices have not been officially revealed on this acreage.

. . . Venezuelan Atlantic Refining Co. paid $810,000 each for three 24,710-acre blocks along the Colombian border. Atlantic also participated in groups which won concessions in Lake Maracaibo, Gulf of Paria and Apure.

Japanese Deal with Saud

● Neutral Zone concession in the Persian Gulf may have been awarded to Yamashita after talks in Saudi Arabia

A JAPANESE company may have come through with a concession in the Persian Gulf.

Reports from Tokyo spelled out details of a grant by Saudi Arabia to Japan Export Oil Co. covering the kingdom's undivided half interest in offshore areas of the Neutral Zone. The offshore area lies north of Arabian American Oil Co.'s concession.

The Japanese company's concession reportedly covers 31,000 sq. miles. The award may also include some blocks on the Saudi Arabian mainland on the Red Sea Coast, which is also outside the Aramco area.

No confirmation of the agreement had come from Saudi Arabia last week. For this reason, the Japanese reports were viewed with a wait-and-see attitude in many quarters.

The reports sprouted after the return from Saudi Arabia of a man with a reputation for knowing how to do business in a big way. He is Taro Yamashita, a tycoon who played a big part in the Japanese development of Manchuria before World War II.

Besides heading Japan Export, he also is president of a steamship company.

If Yamashita did go home with the agreement in his pocket he is supposed to have, here is what it means to the industry:

. . . Persian Gulf concession holders can take comfort in the fact that the concession is along traditional lines.

There seems to be none of the disquieting provisions, such as the 70-30 split that had been erroneously reported on the Qum deal.

. . . Development must wait, in all probability, until Kuwait decides what to do with its undivided half interest in the same offshore area. The old bugaboo of undetermined boundaries also needs to be settled.

Agreement is provisional . . . The agreement Yamashita purportedly brought home is provisional. It gives Japan Export until September to make a down payment of $2,800,000, after which the concession would become formal.

The main terms of the agreement appear to be similar to other Persian Gulf concession arrangements. The Japanese company would retain management of exploration and production. Production could be disposed of as the company wished. Net profits would be divided 50-50 between the company and government.

The Japanese appear to be confident that once under way they can develop 200,000 bbl. daily crude production within 3 years at a cost of $100,000,000. Japan currently imports about 300,000 bbl. daily from the Persian Gulf.

Concessions covering the Neutral Zone mainland are held by Getty Oil Co., holding the Saudi interest, and American Independent Oil Co., with Kuwait's interest. The companies jointly produce about 40,000 bbl. daily from Wafra field.

Iraq Cuts Discount

It means more taxes, less sales discount for I.P.C.

IRAQ PETROLEUM CO., LTD., and the Iraqui Government have agreed to cut the sales discount on crude from 2 to 1 per cent.

The agreement is a further whittling away of the once substantial offtaker discount.

Iraq will gain an additional $1,400,000 in revenue this year as result of the agreement, which is retroactive to January 1.

Other Middle East countries can be expected to make similar arrangements since the usual concession contract has a "most favored nation" clause granting the best terms available elsewhere in the region.

The I.P.C.-Iraq agreement, while increasing the country's revenues, was still within the framework of the concession terms.

Background . . . Middle East countries have always recognized an allowance for sales expenses on crude. Just how much allowance should be made has been under discussion for several years.

At one time, owners of concession holding companies were generally allowed a so-called offtaker discount price of about 32 cents per barrel below posted price.

This offtaker discount was eliminated and replaced by a 2 per cent discount in Iran as part of the agreement with consortium companies. Other Middle East countries followed suit.

Saudi Arabia wants to grant a deduction of actual sales costs and drop the 2 per cent discount.

The posted price for 36°-36.9° gravity Kirkuk crude on the Mediterranean coast is $2.69 per barrel. But the 1 per cent discount is figured at the theoretical border price of the crude, which is lower. This is based on a deduction of pipeline costs through Lebanon and Syria.

The discount is based on actual posted price at Fao, on the Persian Gulf. This is $1.87 per barrel.

Chile Plans Line

Products line to extend from Concon to Santiago

CHILE is planning to build a 75-mile, 10-in. products pipeline from its coastal refinery to inland markets now supplied by rail and truck shipments.

The project, being designed and engineered by Williams Brothers, will extend from the government refinery at Concon to Santiago. Initial capacity with one pumping station at Concon, will be 30,000 bbl. per day. Capacity of the refinery will be increased from 20,000 to 44,000 bbl. daily if a planned expansion is carried out. Chile itself produces 10,600 bbl. of crude daily, and imports the balance of its needs.

The line has been under consideration for several years. It will be built by Empresa Nacional de Petroles, the government company; Cia. de Petroleos de Chile (Copec), a private marketer; and others engaged in marketing and distribution in Chile.

Design plans will be in the hands of the sponsors August 1. No construction timetable has been set.

The line will rise from sea level to some 2,400 ft. as it moves from the flat lands along the coast into the Andes foothills.

Sicily Will Get Deep Test

The British Petroleum Co., Ltd., subsidiary in Sicily has staked location for its second deep test on the island.

Rig is en route from Britain to drill the 1 Troitta near Caltagirone, several miles northwest of Gulf Oil Corp.'s Ragusa field.

B.P.'s first test near Vittoria found extremely low-gravity crude 3 years ago. The field is not on commercial production, but the company plans a test program to see whether the field can be developed as a source of asphalt for Italy's new road-building program.

Third producer looks good:

Deep Venezuelan Play Spreads

A 5-MILE stepout, which may be the center well of a new extensive deep producing trend in Eastern Venezuela, is being completed for better than 1,600 bbl. daily.

The test, Aguasay 4, is the third well in the trend to show this kind of potential. It is being dually completed by Venezuelan Petroleum Co. (Sinclair), the company which started a new flurry of drilling activity in this Greater Oficina area last October.

Five miles to the west, Mene Grande Oil Co. (Gulf) is on the verge of making the same kind of a completion at Zulus 1.

Aguasay 4 was drilled to a total depth of 13,632 ft. A drill-stem test of the T-2 sandstone produced 36.7°-gravity crude through a ¼-in. choke at the rate of 799 bbl. daily. The flow was through perforations in the 13,198-13,224-ft. interval.

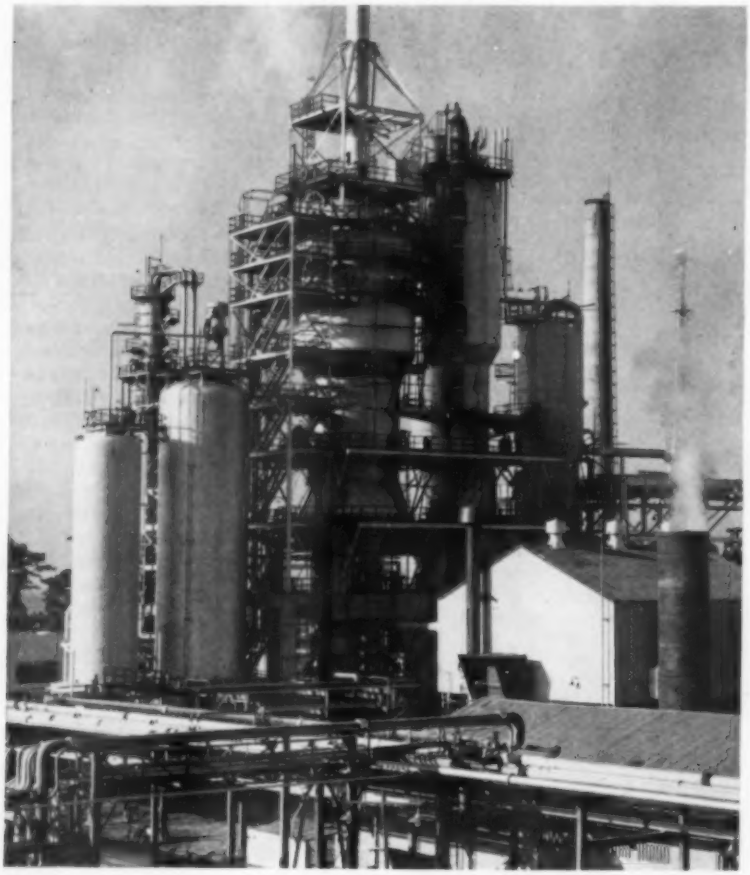
A similar test of the U-3 sand from 13,382-13,400 ft. produced 815 bbl. daily of 37°-gravity crude through a ¼-in. choke. Both are Oligocene sands in the lower Oficina formation. The U-3 is also known locally as the Periquito formation.

The pay was encountered higher in Aguasay 4 than in either Aguasay 3, the discovery, or in Caro 1, the recently completed Atlantic-Pancoastal offset to the discovery well *(The Oil and Gas Journal, March 25, page 120)*.

The Sinclair subsidiary plans to offset this western discovery. Location for Aguasay 4-2 has already been staked to the east of the latest success. The company is still drilling below 12,500 ft. at Aguasay 3-3, about 3,000 ft. to the north of Aguasay 3. Sinclair plans to move a third rig into the field to continue its development of the area. The Atlantic-Pancoastal combine will probably move a second rig onto its 13,411-acre San Jose de Guanipa concession to the northeast if Caro proves as successful as its first well.

The pipeline . . . Work has already been started on a 8-in. crude line to serve Aguasay field. The line will link the field to a 16-in. crude line 30 miles to the north. The larger line is owned jointly by Sinclair, Mene Grande and Creole Petroleum Corp. and moves crude from Santa Barbara to Puerto La Cruz on the coast *(The Oil and Gas Journal, March 4, page 82)*.

Tankage is already being erected and the Sinclair company plans to have the line in operation and Aguasay crude moving to deep water by the middle of May.



Rising Sun: This Model IV combination fluid catalytic cracking unit is the latest addition to the fast-expanding Toa Nenryo Kogyo K.K. refinery at Wakayama, Japan. The $9-million unit has a fresh-feed capacity of 12,200 bbl. daily. It was designed to make high-octane gasoline in conjunction with a fluid hydroformer completed a year ago. Standard-Vacuum Oil Co. has a 55 per cent interest in the 47,000-bbl. refinery. A continuous expansion program has been under way since it opened in 1950. A new alkylation unit will go on stream this month.

Dutch Let Acreage

Jersey, Dutch-Shell combine expands its old concession

NEDERLANDSE Aardolie Mij. (N.A.M.), the only exploration company in The Netherlands, has widened its holdings in the western Netherlands.

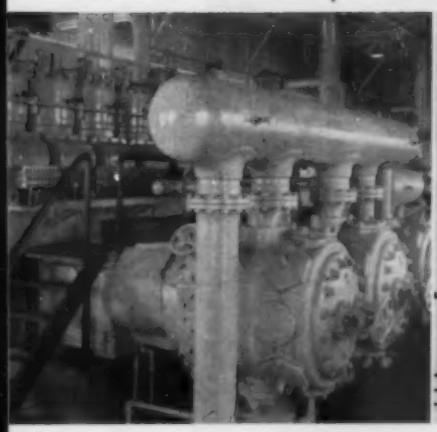
The Royal Dutch-Shell and Standard Oil Co. (N. J.) company has received a new concession covering 496,000 acres. It includes the old 41,000-acre Delft-Rijswick concession where several small fields have been found.

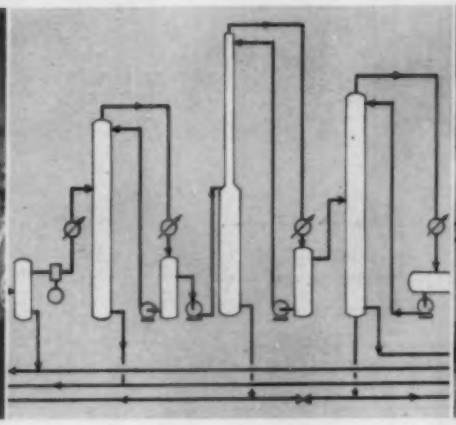
The enlarged area is roughly triangular. The base runs along the Rhine River, beginning east of Dordrect and running to a point in the North Sea 3 miles off Hoek van Holland. The sides run northerly, meeting on the coast west of Haarlem.

N.A.M. has found eight new fields in the old concession on the average of one every 3 or 4 months. Most are two or three-well fields flowing a few hundred barrels daily.

The fields are within a few miles of each other in The Hague-Rotterdam area. But they are individual fields located on separate and distinct faults. Production is from Lower Cretaceous.

A SPECIAL SECTION



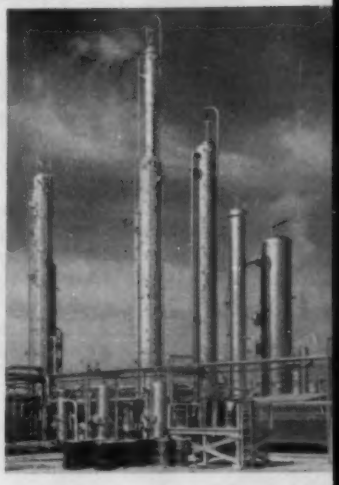


Field Processing

Still growing, and in the forefront of technical progress

. . . In this section

- What We've Learned About Gas Dehydrators
- Propane Can Be Pipelined—Here's How
- Instrumentation Advances on Five Fronts
- Sweetening Natural Gas With Ethanolamines Solutions
- A Look at Vapor-Phase Chromatography
- Texas Natural Moves Into Montana
- Don't Waste That Power—Put It to Work
- How to Calculate Lean-Oil Vaporization Loss
- Wellhead Dehydrators in San Juan Basin
- How Much Automation in Process Plants?
- Natural Gasoline-L.P.G. Output Up 6.6 Per Cent
- Natural-Gasoline-Plant Survey
- Cycling-Plant Survey
- Who's Building, Where, and Capacities



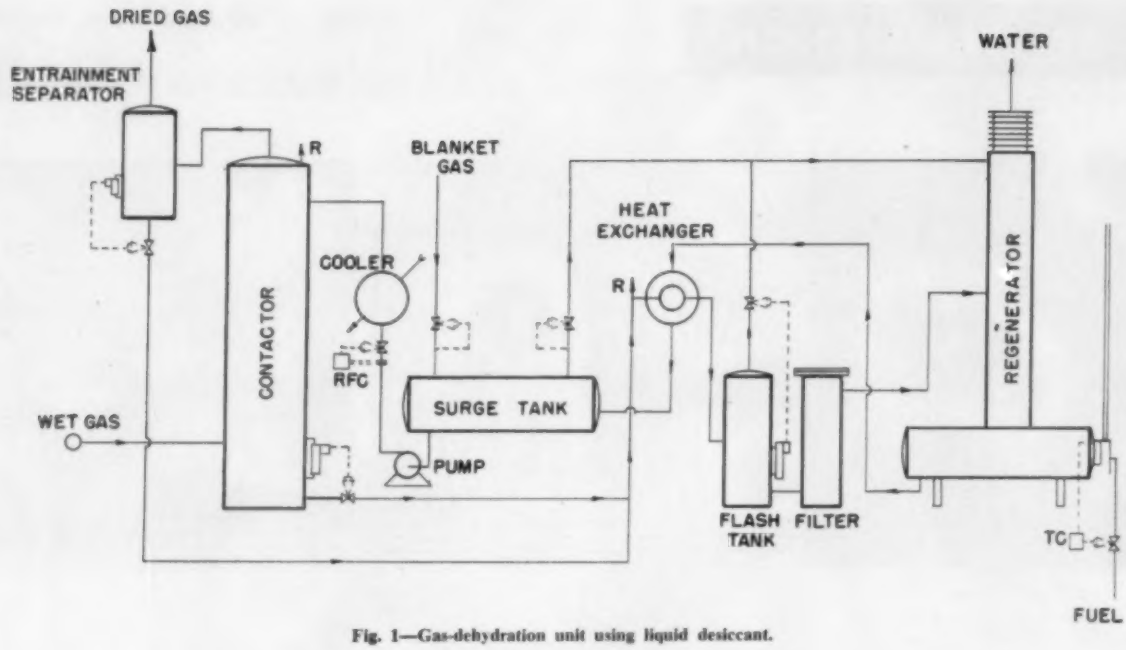


Fig. 1—Gas-dehydration unit using liquid desiccant.

What we've learned in 20 years about Gas Dehydrators

Many years of experience by Magnolia Petroleum Co. with dehydrators is included in this special report on the process design and operation of glycol-absorption and solid-desiccant dehydration systems.

by Will Swerdloff

THE most commonly used gas-dehydration processes are the glycol process and the one employing solid desiccant.

A typical flow sheet for the glycol dehydration process is shown in Fig. 1. Concentrated glycol solution flows countercurrent to the gas being dried down through the contactor and then through a heat exchanger to the regenerator where the water removed from the gas is distilled. The regenerated glycol solution is returned to the contactor for further use. The flow sheet also shows our equipment preferences for the process. We use a filter for removing any solids that may accumulate because of corrosion or possibly decomposition. We also

Author is with Magnolia Petroleum Co., Natural Gas Department, Dallas, Tex. Paper presented at Gas Conditioning Conference, March 6, 1957, University of Oklahoma, Norman.

A quick review . . .

ABOUT 25 years have passed since water vapor was first removed from natural gas in large volume. The first process used a circulating stream of calcium chloride brine to remove the water vapor. The use of calcium chloride brine had some disadvantages, the principal ones being the corrosivity of the solution and its inability to obtain high dew point depressions.

About 20 years ago the first diethylene glycol system was installed to dehydrate natural gas. This was superior to calcium chloride brine in that the pure solution was not corrosive and also gave better drying. Glycol solutions have become the most common liquid desiccant for drying gas. During the last 8 years, the use of triethylene glycol instead of diethylene glycol has become widespread because of an apparent greater drying efficiency and increased resistance to decomposition.

Two or three years after diethylene glycol was first used to dry gas, activated alumina was used as a solid desiccant in a semicontinuous process for gas drying. The use of solid desiccants has also continued through the years. Bauxite, Mobilbeads (formerly Sovabeads) and silica gel, are also being used as desiccant for drying natural gas. Recently calcium chloride has been receiving some new attention for drying natural gas. A process employing solid calcium chloride is being used in New Mexico.

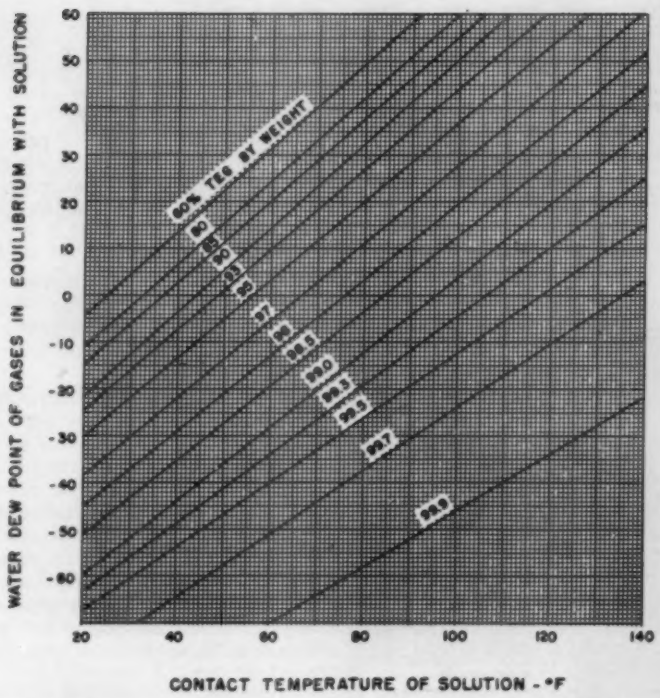


Fig. 2—Water-vapor dew points for gases in equilibrium with aqueous triethylene glycol.

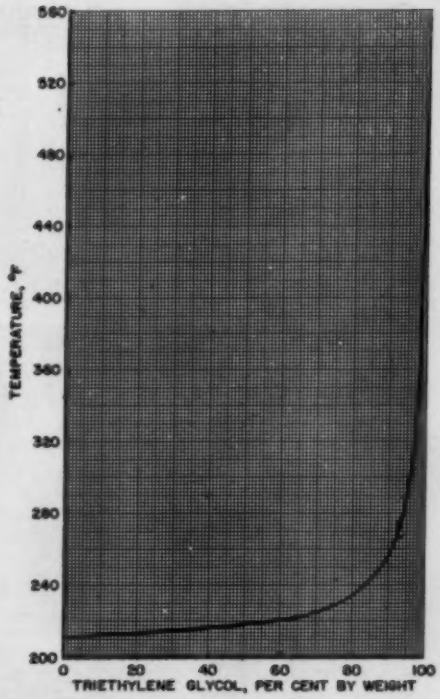


Fig. 4—Triethylene glycol-water boiling point vs. composition at 760 mm.

use a flash tank ahead of the filter for better filter performance and for separating natural gas which may be corrosive so as to bypass the hottest part of the still. The flow sheet is the same equipmentwise as would be used for diethylene glycol.

Process selection . . . Selecting a dehydration process depends on the performance that is required. Fig. 2 shows calculated water-vapor dew points of natural gas when at equilibrium with various concentrations of triethylene glycol solution at various temperatures. These equilibrium dew points are those that would be obtained with an infinite circulation rate. In practice, we cannot reach the equilibrium dew point because the gas dried in an operating plant is in effect in equilibrium with a more dilute glycol solution than that which is fed to the contactor. The dilution is because of the absorption of water from the wet gas.

Calculated dew-point depression . . . Fig. 3 gives the calculated dew-point depression of the dried natural gas for various circulation rates of triethylene glycol solutions. Dew-point depression is the difference between the inlet-gas temperature and the dew point of the dried gas both at the same contactor pressure. The last statement assumes that the gas to the contactor is saturated with water which is the usual case.

It is apparent from Figs. 2 and 3 that extent of water removal is dependent upon the water content of the lean glycol solution. If we could regenerate glycol so that it had no water content there would be no apparent limit to its drying ability. This is similar to all absorption processes wherein the absorbent must be free of a constituent to have the greatest absorption of the same constituent from the gas.

Circulation rate . . . Fig. 3 shows that the rule-of-thumb circulation rate of 3 gal. of absorbent per pound of water content in the gas will easily give dew-point depressions of 50° to 60° F. It also shows that increased water content reduces the effect of the circulation rate on dew-point depression. Also, it shows that reducing the water content of the regenerated glycol permits greater dew-point depressions.

Reboiler temperature . . . Fig. 4 shows the temperature at which a glycol still reboiler would have to be carried at atmospheric pressure to obtain a lean glycol with a given water content. Introduction of natural gas as a stripping medium will reduce the water content. Since most people do not operate at a temperature above 400°

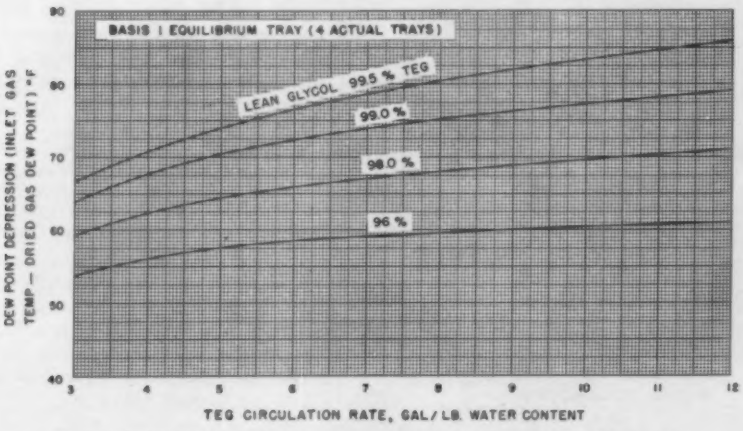

BASIS 1 EQUILIBRIUM TRAY (4 ACTUAL TRAYS)
LEAN GLYCOL 99.5 % TEG
99.0 %
98.0 %
96 %
DEW POINT DEPRESSION (INLET GAS TEMP — DRIED GAS DEW POINT) °F
TEG CIRCULATION RATE, GAL/LB. WATER CONTENT

Fig. 3—Calculated dew-point depression vs. triethylene glycol circulation rate.

TABLE 1—OPERATING DATA FOR TRIETHYLENE GLYCOL GAS DEHYDRATION UNITS

Plant	Contactor pressure (psig.)	Wet gas temperature (°F.)	Glycol rate gal./lb. water content	Reboiler temperature (°F.)	Dew-point depression (°F.)
1	665	87	3.17	350	57
2	665	79	7.90	350	62
3	500	78	2.75	355	*66
4	575	87	15.2	342	†73
5	945	95	5.55	387	64
6	1,020	96	10.0	322	59

*Contactor has five trays. †Contactor has six trays.

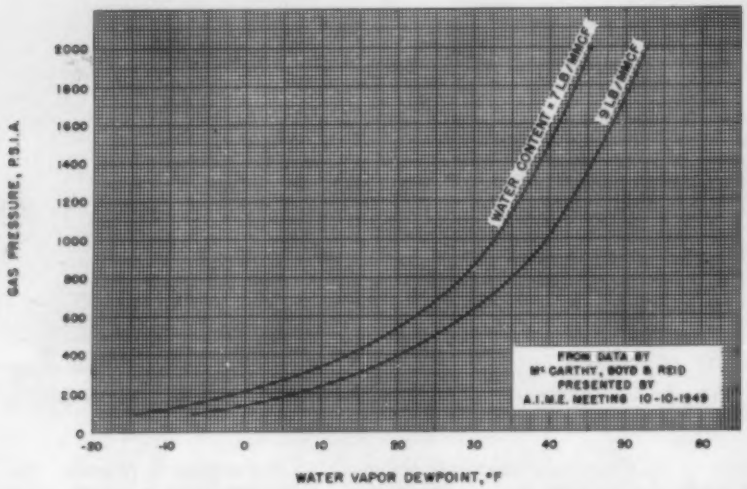


Fig. 5—Water-vapor dew-point temperature vs. gas pressure for constant water contents.

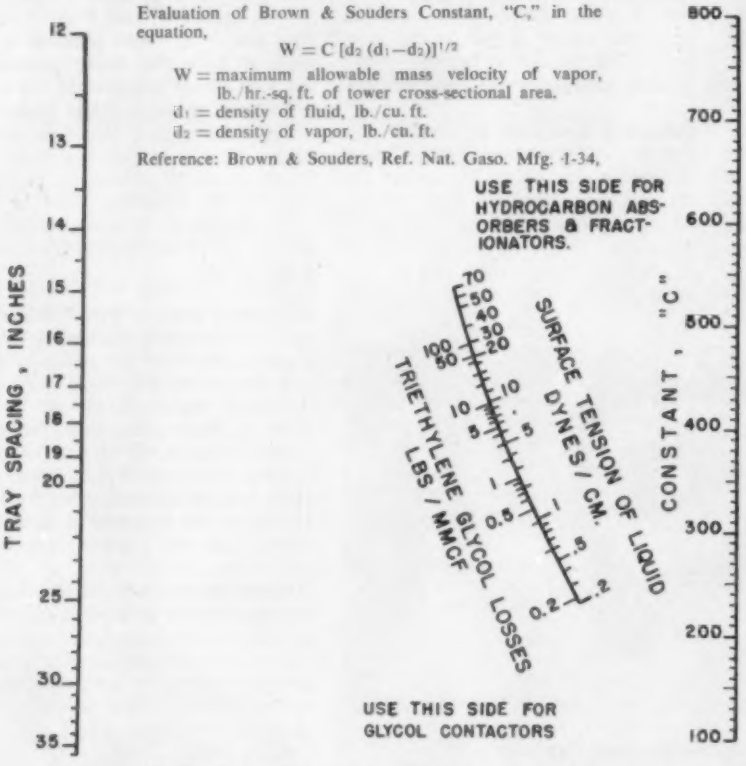


Fig. 6—Tower diameter when entrainment is limiting.

Field Processing

F. because of fear of decomposition, it is apparent that about the best we can do at atmospheric pressure is obtain glycol with about 1 per cent water. Of course, if vacuum regeneration were used, we could obtain glycol with less water but this will be at an added price.

We have considered a 75° F. dew-point depression as the maximum when designing a glycol gas-drying system. Table 1 shows operating experience of several glycol dehydration plants.

Fig. 5 shows how the water content of natural gas used in most sales contracts is related to dew points at various pressures. Knowing the limit of lowering of dew point, we can calculate from Fig. 5 the maximum temperature and the lowest pressure at which we can dry gas to get required performance from a glycol unit. A solid-desiccant unit is the alternative when sufficient lowering of dew point cannot be obtained from a glycol unit.

Design Basis—Glycol Unit

Absorber . . . Determining the absorber diameter for a glycol unit may be a more trying matter than calculating an absorber for a gasoline-absorption plant. The complication arises from the fact that glycol solutions may be subject to foaming. This will tend to increase glycol losses above desired limits.

Fig. 6 gives the C factor for the customary Brown-Souders equation in terms of glycol losses from the top of an absorber. These C factors were calculated from data on an absorber containing vane-type mist extractors.

Our preference is to size the absorber for a glycol loss of 1 lb. per M.M.s.c.f. Of course, a more efficient entrainment separator in the contactor or external to the contactor would reduce the loss.

It has been customary in the past to use four trays in the contactor. We have had some indication that there may be an advantage in using more than four trays.

Glycol still . . . The glycol still is a two-component fractionator for the system water-triethylene glycol. With the boiling point of water being 212° F. and that of glycol 549° F., it is apparent that the separation of water is a very easy operation. About 12 ft. of packing and reflux generated by the heat loss is sufficient for this separation. The diameter of the still can be obtained by customary methods for packed towers.

Glycol circulation rate . . . The glycol

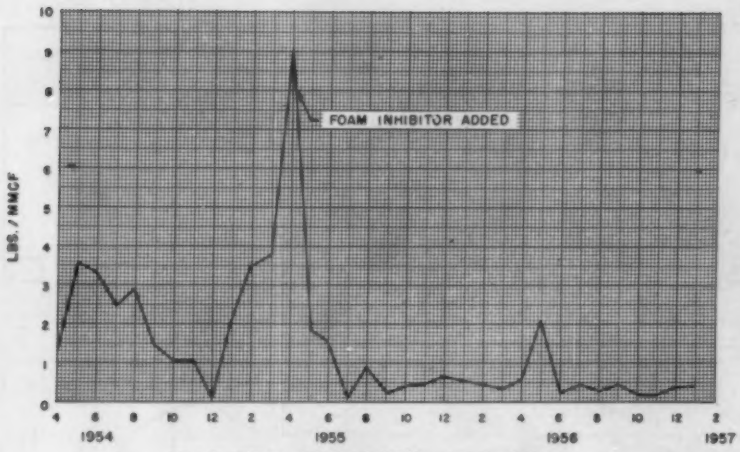


Fig. 7—Effect of foam inhibitor on glycol loss.

circulation rate may be obtained from Fig. 3. This has been mentioned previously. Fig. 3 may be criticized because it is based on one equilibrium tray whereas the several trays of an operating contactor give the benefits of countercurrent operation. Operating data have shown that equilibrium trays in different four-tray contactors may vary from 0.75 to 1.25. Any benefit because of countercurrent operation not shown by the calculation is compensated to some extent by the small temperature rise that occurs on the contactor trays.

For Fig. 3 the example calculations used the inlet gas temperature as controlling. This is particularly true at pressures of about 500 psig. and higher where the mass of gas greatly exceeds that of the liquid absorbent. The equilibrium data by Porter and Reid[1] for water-triethylene glycol were adjusted for the calculations to remove the reported retrograde minimum. We know of one unit operating at a pressure of 3,200 psia. The dew-point depressions on Fig. 3 are little affected by pressure. This figure permits calculating the maximum temperature at which a glycol unit can be operated for a required dew point of the dried gas as well as other limits of operation.

Operating Problems

Glycol losses . . . The loss of glycol may be the most important operating problem. Contamination of glycol by hydrocarbons, finely divided solids, and salt water may promote foaming that will result in increased glycol consumption. We stringly recommend that all dehydration units, whatever kind, be preceded by an efficient inlet separator. This will remove water which wastes dehydration capacity, reduce hydrocarbons contaminating the glycol, and decrease the possible buildup of salt content.

Reducing losses . . . We consider a glycol loss of 1 lb. per M.M.s.c.f. of gas being dried as acceptable. Some companies use less than this quantity as an average. Foaming of glycol may cause a great increase in glycol losses. This is indicated by Fig. 7. This shows how glycol losses were greatly decreased by the addition of a foam inhibitor, in this particular case, trioctylphosphate. Prior to the addition of the foam inhibitor, glycol losses on a daily basis rose as high as 15 lb. per M.M.c.f.

Up until the addition of the inhibitor the external residue scrubber was apparently unable to separate liquid. The inhibitor used in the concentration of 500 p.p.m. reduced the loss as shown to less than 0.5 lb. per M.M.c.f. We have another plant which has two mist eliminators made of metallic mesh material in the top of the contactor followed by an external mist extractor. This particular plant has given us no difficulty with

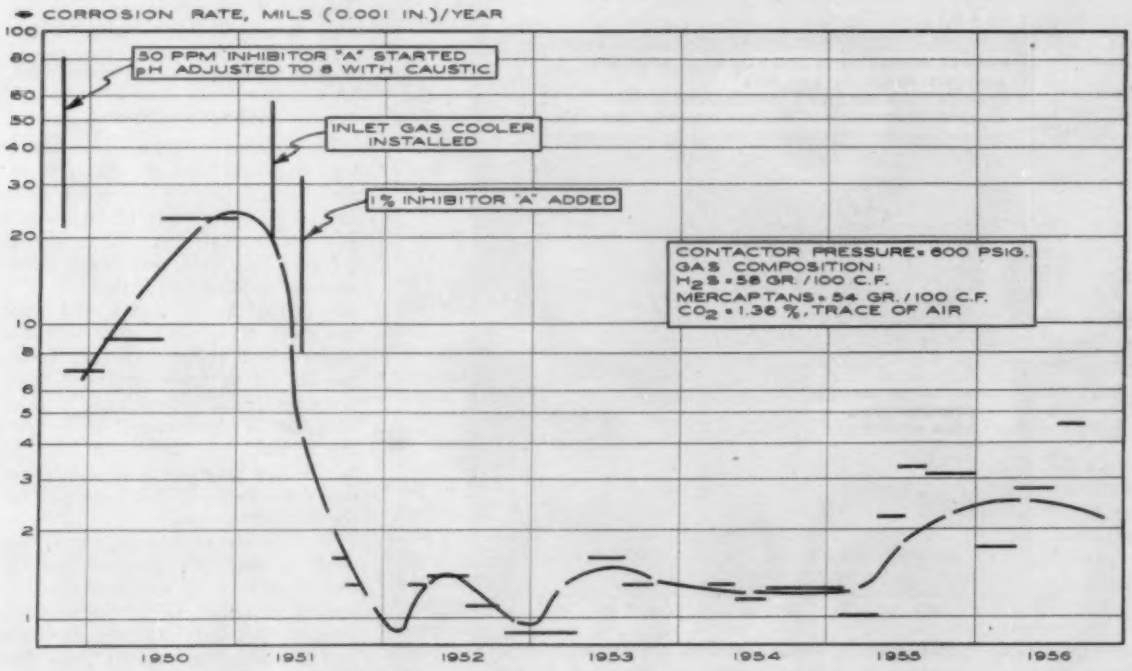


Fig. 8—Cold rich glycol solution coupon corrosion rates.

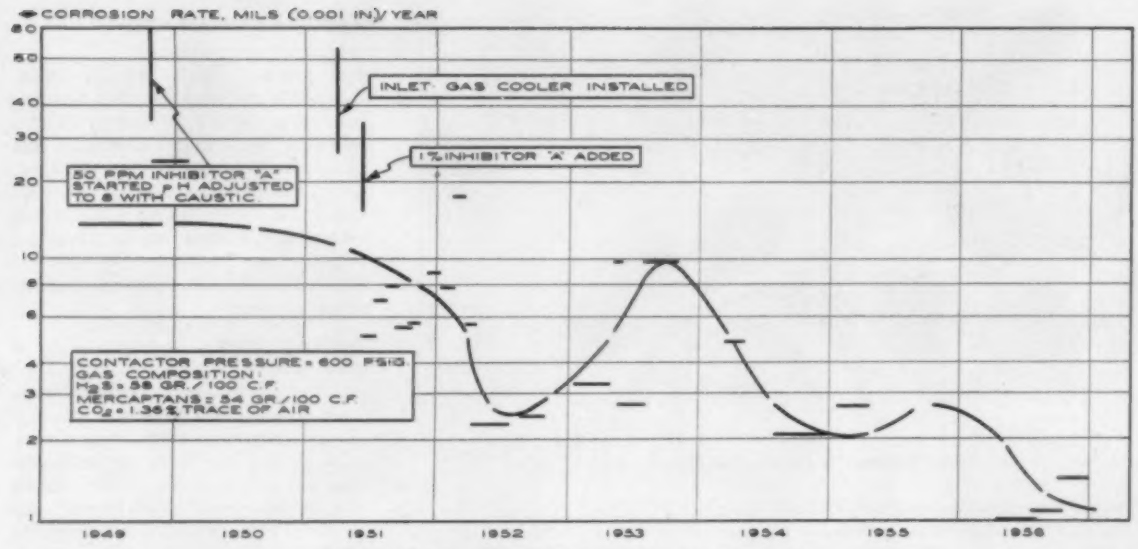


Fig. 9—Hot lean glycol solution coupon corrosion rates.

Field Processing

foaming and our losses to date have been about 0.15 lb. per M.M.s.c.f.

Corrosion . . . Glycol solution may become corrosive because of impurities in the gas being dried and cause problems in a glycol dehydration unit. All precautions should be taken to keep air out of the glycol solution. This means keeping a gas blanket on the glycol surge tank. The presence of acidic components such as carbon dioxide and hydrogen sulfide will give further difficulties. We have found that the use of a corrosion inhibitor, sodium mercaptobenzothiazol in a concentration of 1 weight per cent, has given us benefits as indicated by coupon study results shown in Figs. 8 and 9. These are for a plant with a 600 psig. contactor wherein the gas being dried contains 58 grains per 100 cu. ft. of hydrogen sulfide and 1.36 per cent carbon dioxide and traces of air. Other inhibitors should also be tried for different conditions.

The coupon results indicate that the hot solution corrodes at a greater rate than the cold solution most of the time. The results show the confusion attendant to interpreting coupon results. Corrosion of coupons is not corrosion of equipment. At the end of 1955 we replaced the still for which the coupon results are given. We know that the corrosion rate was much higher during the years before corrosion control measures were taken and we hope that larger damage was not done after that time.

Corrosion because of carbon dioxide will be magnified at higher pressures. Glycol solution circulated through all the equipment can cause many headaches if it is corrosive. Entrained corrosive glycol has caused pipeline blowouts.

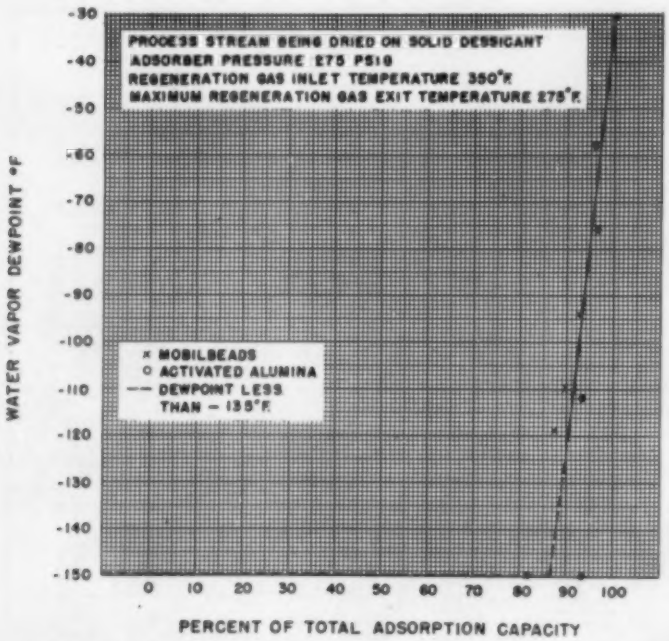

PROCESS STREAM BEING DRIED ON SOLID DESSICANT
ADSORBER PRESSURE 275 PSIG
REGENERATION GAS INLET TEMPERATURE 350°F
MAXIMUM REGENERATION GAS EXIT TEMPERATURE 275°F
× MOBILBEADS
○ ACTIVATED ALUMINA
— DEWPOINT LESS THAN −135°F
WATER VAPOR DEWPOINT °F
PERCENT OF TOTAL ADSORPTION CAPACITY

Fig. 10—Effect of water adsorption on dew point of dried gas.

Adsorption Process

Dehydration processes employing solid desiccant have the ability to remove practically all the water from natural gas. Also it can be used where gas dehydration temperatures are at a higher level than that where glycol solution is satisfactory. Because of a very great drying ability, the solid desiccants have been used in those places where higher efficiency is demanded or in low-temperature fractionation plants where only a solid desiccant is satisfactory. When drying a field gas, desiccants such as Mobilbeads may give a substantial hydrocarbon recovery that helps pay for the dehydration unit.

Fig. 10 shows dew points of gas dried by both F-3 activated alumina and Mobilbeads at a plant recovering natural gasoline by a refrigeration process. The data obtained during a test of adsorption capacity show that no dew point could be found for either

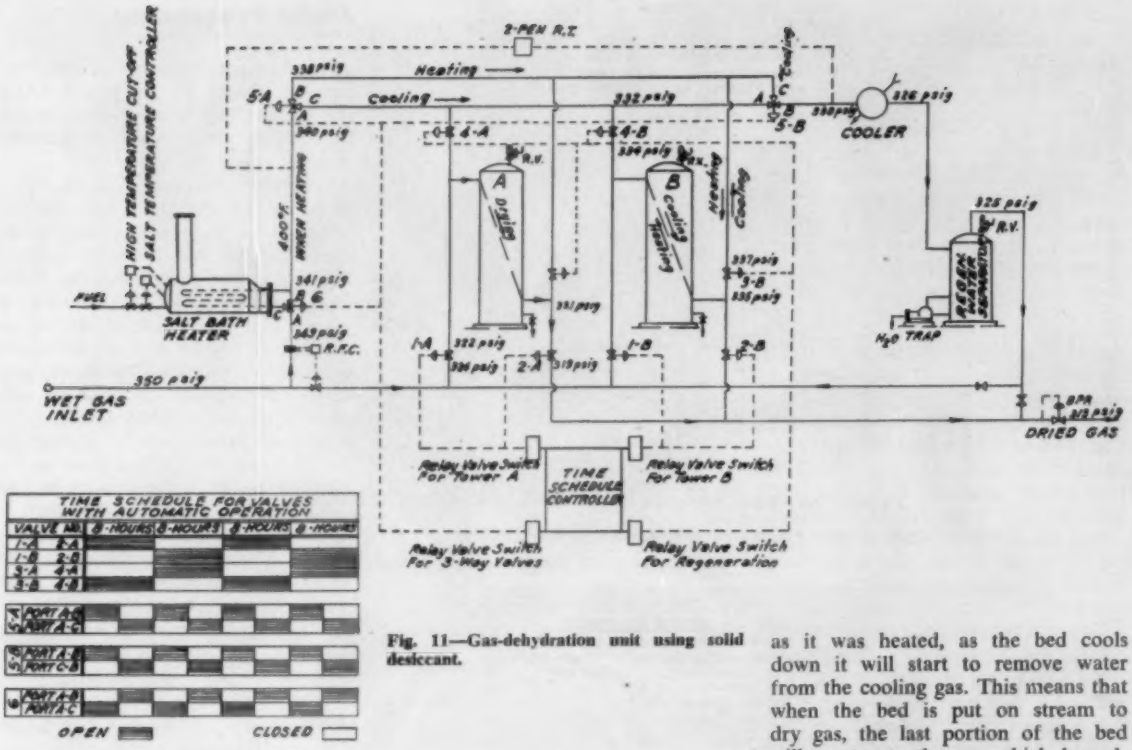


Fig. 11—Gas-dehydration unit using solid desiccant.

Field Processing

desiccant for most of the dehydration cycle. It is apparent that there is little difference in terms of dew point attainable with these desiccants. During normal operation, the length of the gas-drying cycle is shorter than the test cycle so that minimum dew point is obtained at all times.

Desiccants . . . Activated alumina was used as solid desiccant for dehydrating natural gas about 20 years ago. Shortly thereafter some people began to use bauxite. During the last 10 years the use of a new desiccant product, Mobilbeads, also grew into prominence. More recently silica gel, which had been used as an air-drying agent, has become available for natural gas use. Our experience has been with F-3 activated alumina and Mobilbeads and our discussion of adsorption processes will be limited to these materials.

Fig. 11 gives a rather detailed flow sheet showing a typical solid-desiccant dehydration system. This particular plant is completely instrumentized for automatic switching by a time-cycle controller. As will be discussed later, piping is such that minimum dew-point gas may be made at all times.

Because of the necessity of handling the solid adsorbent batchwise, a minimum of two separate charges of desiccant is required. While one charge is removing the water vapor from the gas the other is being regenerated for use when the drying ability of the previous charge is exhausted.

Regeneration . . . Desiccant regeneration may be accomplished by bypassing a part of the wet gas through a heater and then up through the tower countercurrent to the gas-drying direction. The gas which is saturated at ordinary temperature is able to regenerate the desiccant because heating it to 400° F., for example, reduces its relative humidity to less than ½ per cent.

Cooling cycle . . . The desiccant bed is cooled, with the heater bypassed, by the same gas used for heating. If minimum dew point is wanted at all times the direction of the cooling gas through the adsorbent should be the same as that when drying gas. If the bed is cooled in the same direction as when heated there will be a period of time after the beds are switched when the dew point of the dried gas will be at a higher value. The reason for this behavior is that water adsorption proceeds in a zonelike fashion. The first layer of adsorbent becomes completely saturated with the water from the gas. The next lower layers come into play as the upper layers become saturated. If the adsorbent bed is cooled in the same direction as it was heated, as the bed cools down it will start to remove water from the cooling gas. This means that when the bed is put on stream to dry gas, the last portion of the bed will resaturate the gas which has already been dried in the upper portion of the bed until the water accumulated from the cooling gas is exhausted.

To minimize dew-point effects because of the cooling gas, we stop the cooling cycle when the temperature of the cooling gas from the bed drops to 30° above the cold-gas temperature to the dryer.

The gas being used for regeneration is cooled in order to separate the water from the adsorbent during the regeneration cycle. The cooled gas then has about the same content as the inlet gas and joins with it for dehydration. This is made possible by taking the pressure drop across the rate-of-flow control valve that diverts the regeneration gas. On a small plant, taking this pressure drop is not of too much significance. However, if a large volume of gas is being dried it would be better to install a compressor to boost the relatively small volume of regeneration gas rather than taking the horsepower loss on most of the gas.

Design Basis—Adsorption Unit

Adsorbers . . . Sizing of adsorbers towers depends on the length of time of the gas-drying cycle and the design water-adsorption capacity for the desiccant. We normally choose an 8-hour gas-drying cycle. This, then, gives us 8 hours for heating and cooling the second tower during regeneration. For maximum safety we design beds for a water-adsorption capacity equal

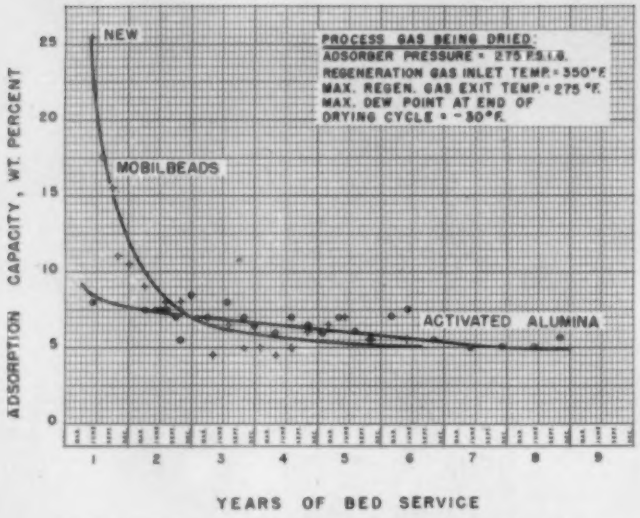

NEW
PROCESS GAS BEING DRIED:
ADSORBER PRESSURE = 275 P.S.I.G.
REGENERATION GAS INLET TEMP. = 350°F
MAX. REGEN. GAS EXIT TEMP. = 275 °F.
MAX. DEW POINT AT END OF
DRYING CYCLE = -80°F.
MOBILBEADS
ACTIVATED ALUMINA
ADSORPTION CAPACITY, WT. PERCENT
YEARS OF BED SERVICE

Fig. 12—Effect of age of desiccant on water-adsorption capacity.

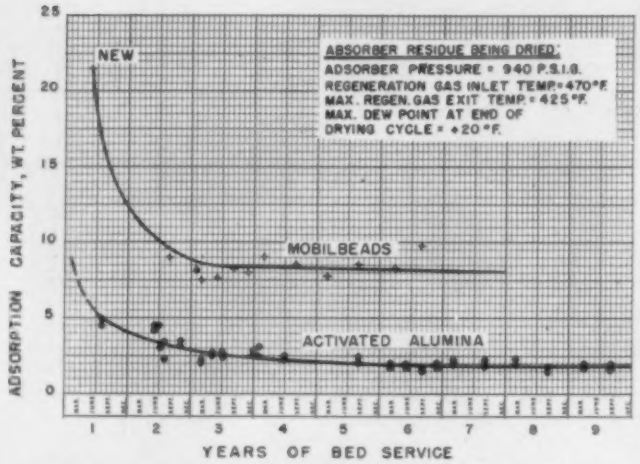

NEW
ABSORBER RESIDUE BEING DRIED:
ADSORBER PRESSURE = 940 P.S.I.G.
REGENERATION GAS INLET TEMP. = 470°F
MAX. REGEN. GAS EXIT TEMP. = 425°F.
MAX. DEW POINT AT END OF
DRYING CYCLE = +20°F.
MOBILBEADS
ACTIVATED ALUMINA
ADSORPTION CAPACITY, WT. PERCENT
YEARS OF BED SERVICE

Fig. 13—Effect of age of desiccant on water-adsorption capacity.

to 5 per cent of the weight of desiccant.

When an adsorbent bed is new, its capacity will be much larger than 5 per cent and gas-drying cycle two or three times the 8 hours can be used.

Effect of desiccant age . . . Desiccant capacity, in terms of its life, depends on several factors besides the particular brand of desiccant. These are composition of the gas, regeneration conditions, and treatment of the desiccant. These effects are reflected in Figs. 12 and 13 and in Table 2.

Fig. 12 shows the effect of age on the adsorption capacity of Mobilbeads and of activated alumina at a plant where hydrocarbons are recovered from natural gas by refrigeration. Regeneration temperatures are relatively low, as shown on the figure. Also the natural gas is very rich containing 14 gal. per M.M.c.f. of propane and heavier at the plant inlet so that much heavy hydrocarbons are being adsorbed by the desiccant. No absorption oil is in use at the plant. Operation has been severe because of occasional liquid reaching the desiccant and because of the reduction of pressure on the desiccant during regeneration. There is little difference between the water-adsorption capacity of the Mobilbeads and that of activated alumina, as shown in Fig. 12.

Fig. 13 gives a similar comparison when drying residue gas from an absorption plant. Here regeneration temperatures are higher so that there is more chance of removing the volatile hydrocarbons. Absorption oil constituents continually reach the desiccant. Here it is apparent that the Mobilbeads have a much higher water capacity after the extended period of operation. The Mobilbeads were installed later than the activated alumina.

More plant data . . . Table 2 gives comparative data and desiccant capacity for many other plants. With our own company making Mobilbeads it is natural that most of our experience is with this material. It can be noted that if regeneration temperatures are sufficiently high and if absorber residue is being dried, the long-time life capacity of the Mobilbeads is more than 5 per cent.

Bed size . . . In choosing the size of adsorption towers we prefer to use a bed length three to five times the diameter. This has permitted us to have towers with reasonable gas velocities. Pressure drop through packed towers may be calculated from usual equations for such flow. However, some pressure drop charts are given in an article by Amero, Moore, and Capell.[2] This article also contains some very good general information on solid-desiccant dehydrators. If the

TABLE 2—OPERATING DATA FOR SOLID DESICCANT DEHYDRATION UNITS

Plant	Type desiccant	Dehydrator pressure (psig.)	Wet gas temp. (°F.)	Type of gas	Regeneration gas inlet temp. (°F.)	Max. temp. end of heat cycle (°F.)	Max dew point, end of cycle (°F.)	Adsorption capacity (wt. %)	Adsorbent age (years)
1	Mobilbeads	690	105	Absorber residue	400	325	32	11.13	4
2	Mobilbeads	690	106	Absorber residue	390	335	32	11.94	4
3	Mobilbeads	800	65	Separator gas	375	325	25	6.91	3
4	Mobilbeads	970	67	Separator gas	410	355	28	9.20	4
5	Mobilbeads	655	75	Separator gas	410	315	24	6.61	2
6	Mobilbeads	1,040	87	Absorber residue	405	370	17	6.48	4
7	Mobilbeads	1,040	98	Absorber residue	405	365	24	9.40	4
8	Mobilbeads	920	87	Absorber residue	370	330	35	6.28	5
9	Mobilbeads	915	88	Absorber residue	370	330	35	6.17	5

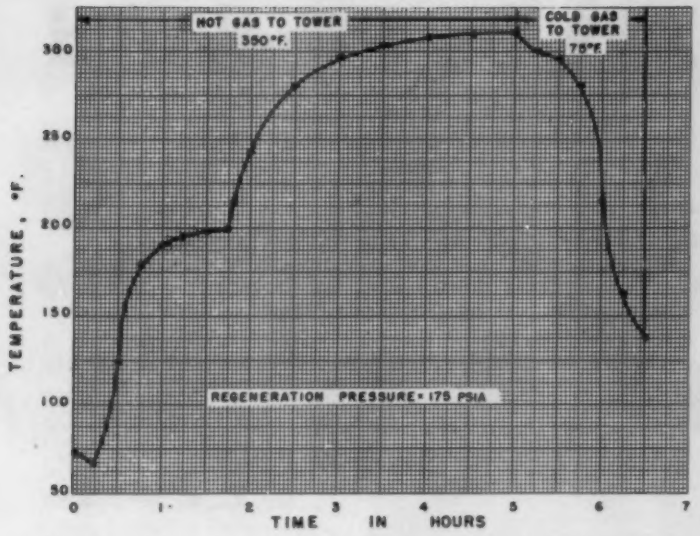


Fig. 14—Regeneration cycle temperature curve for solid-desiccant gas dehydrators.

towers are sized as we have recommended, it will be found that the pressure drop of the desiccant is relatively minor.

Heating of desiccant . . . The temperature to which the regeneration gas is heated should be sufficient to remove the adsorbed water and contaminating hydrocarbons in a reasonable length of time. A temperature of 300° F. is sufficient to remove the water. But for better desiccant life a higher temperature should be used. A minimum temperature of 350° F. is preferable and 400° F. is better.

The quantity of gas needed to regenerate the tower can easily be calculated from a heat balance. This is much more satisfactory than using some arbitrary percentage.

Regeneration temperature gradient . . . From observing the temperatures obtained during regeneration cycle and its behavior the heat balances may be calculated. Such a gradient is shown in Fig. 14. As shown on this curve, typical regeneration behavior shows that the bed is heated in stages. First there is the zone of preheat up to a plateau where the water begins to be evolved. When the end of this plateau is reached most of the water may be considered to be removed. There is a further rise after the plateau during which more of the hydrocarbons that can be volatized may be driven off. We usually heat until a second plateau is reached which is the highest temperature that can be obtained. By setting the time for heating (we usually use 4 hours) we can then calculate the heat loads in each of the zones. For design purposes the 4-hour heating time is divided as follows:

	Hours
Preheat zone	1.25
Evolution of water	1.50
Second use zone	1.25
Total	4.00

The heat load in each zone is that necessary to heat the desiccant, the adsorbent, its adsorbed content, the steel in the vessel, and insulation. In the zone where the water is evolved, the heat of vaporization must be included. Knowing the temperature to which we are heating the regeneration gas we can then determine how much available heat can be removed from the regeneration gas and we can therefore calculate the quantity of regeneration gas for each zone.

This quantity can be adjusted to an average value so that a constant volume may be used during the entire regeneration cycle. The water usually is evolved at a temperature between about 200° and 250° F. regardless of the regeneration pressure.

Cooling of desiccant . . . The quantity of regeneration gas, with the heater bypassed, should be sufficient to cool the desiccant bed in about 2 hours. This means that a total of 6 hours would be used for the complete regeneration process.

Regeneration gas coolers . . . The heat load and mean-temperature difference of this cooler is constantly changing because of the batch nature of the process. The cooler must therefore be sized for that zone of cooling which gives the greatest demand on the coolers. This is usually the time during the plateau of the regeneration heating cycle.

We recommend that a scrubber be installed ahead of the dehydration unit

Field Processing

to remove liquid water and other contaminants from the gas.

Avoid condensation . . . All precautions should be taken to avoid the condensation of water within an adsorption tower. This means insulating all surfaces of the tower including heads and manways and insulating pipelines until they reach a point where condensation cannot flow back into the adsorption towers.

Countercurrent heating . . . Another practice which we follow to give increased desiccant life is to heat the bed during the regeneration cycle in a direction countercurrent to that used in drying gas. This has two advantages: (1) hydrocarbons which contaminate the desiccant and are also adsorbed in the first layers of desiccant are driven out of the tower instead of being driven to the lower portion of the desiccant; (2) also the hottest regeneration gas first contacts that portion of the bed that is least saturated with water.

In concluding this discussion we wish to mention the checking of dehydration units by taking accurate dew points of the dried gases may be difficult because of the condensation of hydrocarbon vapors or the glycol vapor. It is helpful to reduce the pressure at which dew points are measured with a Bureau of Mines dew-point apparatus to a temperature wherein solid can form on the mirror rather than only drops of liquid. The formation of solid on the center of the mirror will help distinguish the water although experience should show the difference between the condensation of liquid water and hydrocarbons.

Also as a check, dew points should be measured at several different pressures. While the dew-point temperature will vary, if correct readings are being obtained the pounds per million of water, as obtained from a plot of dew points versus water content, should remain constant.

Also we wish to mention that sampling lines to a dew-point apparatus should be metal. Rubber or plastic-lined tubing should not be permitted.

Acknowledgment

Ovid Baker's and Frank Scauzillo's contributions to the development of the information in this paper are gratefully acknowledged.

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2. R. C. Amero, J. W. Moore, R. G. Capell, "Design and Use of Adsorption Drying Units," Chemical Engineering Progress, July 1947, p. 349, Vol. 43, No. 7.

Propane CAN Be Pipelined

- Phillips has been pipelining butane for 25 years and propane for 10 years. To pump propane it was necessary to convert to mechanical seals. Higher pump intake pressures are required when handling propane.
- Suitable buffers must be provided when pumping L.P.G. through the same line with distillates.
- Some special precautions are needed when repairing for leaks in the presence of L.P.G. But over-all propane offers no serious operating problems.

by F. B. Neptune

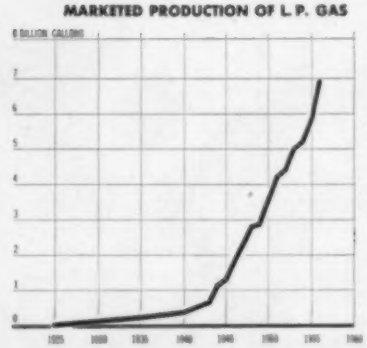
WE have been somewhat surprised by the interest manifested in the past few years by the pipeline segment of the industry in the matter of L.P.G. transportation. Interest appears to be particularly keen concerning pipeline transportation of propane. When one considers, however, the immense increase in the marketed production of L.P.G., starting about 1942, the reason seems quite clear. Marketed production of L.P.G. for the past 32 years is plotted in Fig. 1. Note that in 1956 some 7 billion gallons was marketed. It seems likely that more and more of this large volume ultimately will be transported from manufacturing areas to consuming areas by pipeline.

We have had many inquiries from pipeline people who are interested in our experience in pumping and handling this product. We feel that it all adds up to the fact that, while only a comparatively few pipeline systems are handling L.P.G. today, many pipelines will be handling it soon. For whatever value it might be to those interested in handling propane by pipeline, this report is offered. Note also other articles on the subject.

Earlier Phillips Experience

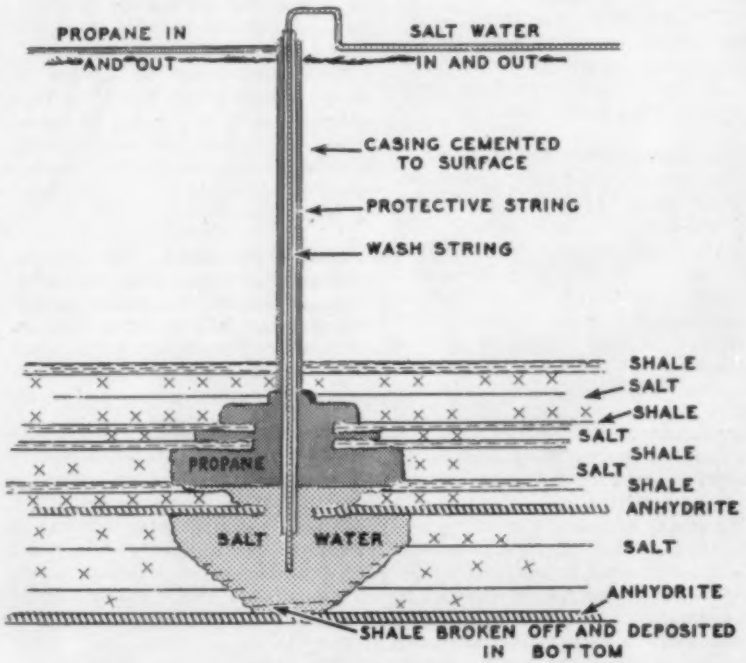
Phillips Petroleum Co. and Phillips Pipe Line Co. have been transporting butane by pipeline since 1931 and propane since December 1947. We began handling propane in large volumes in June 1952 on our system from Borger, Tex., to East Chicago, Ind. Since 1947 we have pumped approximately 17 million barrels of propane.

Author is with Phillips Pipeline Co. at Bartlesville, Okla. Paper presented at Thirty-sixth Annual Conference of N.G.A.A. at Houston, April 24, 1957.



SEVEN BILLION GALLONS in 32 years—and the curve is still climbing. Fig. 1.

Earlier problems . . . Some of our earlier experiences might be of interest to those who are now pipelining L.P.G. or who expect to do so in the future. When our original 8-in. line was built from Borger to East St. Louis in 1931, the line, as was the general practice at the time, was tested with water. Because all of the horsepower on the line was furnished by butane-burning gas engines, butane was put into the line immediately behind the test water so the butane could be drawn off as engine fuel.



SALT-STORAGE CAVERN for L.P.G. shown in a schematic diagram. Fig. 2.

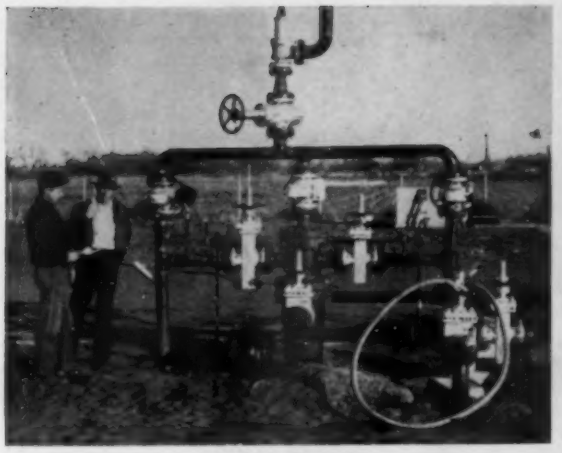


FIG. 3.

FIG. 4.

TYPICAL STORAGE FACILITIES of several types. Fig. 3 shows aboveground piping for salt-wash cavern, Fig. 4 shows a mined cavern under construction, Fig. 5 conventional aboveground propane storage, and Fig. 6 shows propane storage fabricated from pipe.

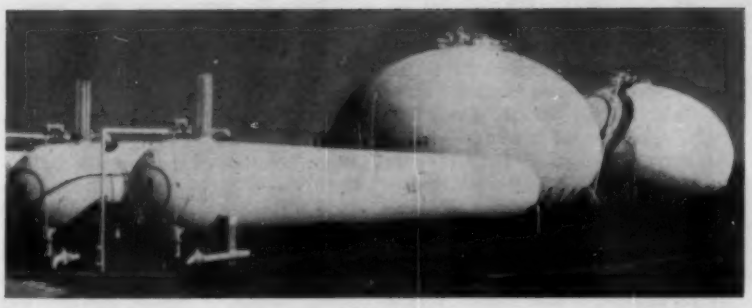


FIG. 5.

FIG. 6.

While this sequence of scheduling was desirable as a means of supplying the initial fuel requirement to the pumping stations without having to haul it to remote locations by truck, it created a number of serious problems. The line scale cut out the pump packing, permitting large volumes of butane to escape in the pump rooms and creating very hazardous conditions at nearly every station. In those early days our operators spent more time in repacking pumps than in any other phase of the operation.

Furthermore, when the butane and water got into the hilly sections of Missouri, between Paola and St. Louis, we found we had in effect created a series of U-tubes with butane in one leg and water in the other. At one time we had 1,000 psi. discharge pressure at Paola station and zero pressure a few stations downstream. Obviously nothing was moving. To get the stream moving it was necessary to tap the line in all the low places and draw down the water. With some butane present, extreme frosting and freezing resulted and for a time we were more in the ice business than in the pipeline business.

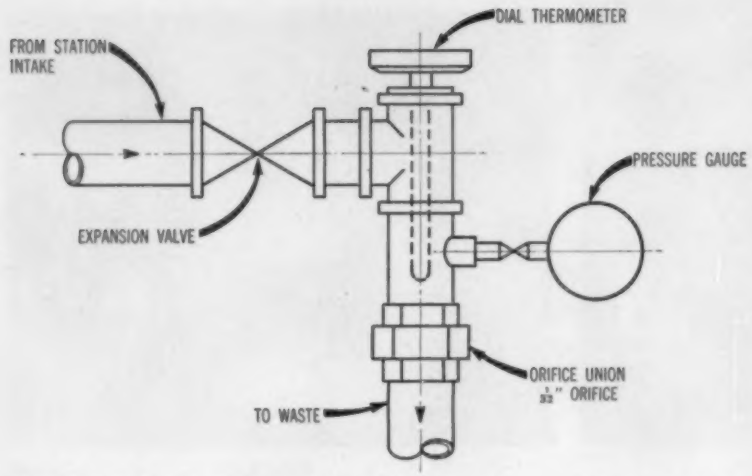
This early and rather hectic experience is recounted for the benefit of those who may find it necessary or desirable to test a new line with water where it is planned to put the line into L.P.G. service. We would strongly recommend that if the line must be tested with water, a heavier product, such as gasoline or kerosine, be put through the line before introducing butane or propane.

Storage for propane at pipeline

Field Processing

origin and at terminals can be either aboveground or underground. Usually, regardless of the amount of underground storage, some aboveground storage must be provided for quality control and to maintain the desired feed rate to the pipeline. Normally it will be expensive and impractical to attempt to feed a high-volume pipeline from an underground source. This would be particularly true if the product must be refractionated and dried as it comes out of the underground.

Several types of storage are commonly used today for storing propane along pipelines. Perhaps the most widely used type of high volume storage is the underground cavern washed from a salt bed. While this type of



SIMPLE BUT EFFECTIVE assembly for determining the approximate vapor pressure of the product passing the station. Fig. 7.

storage is relatively inexpensive, the location, of course, is limited by the availability of suitable salt strata. Successful underground caverns also have been mined in suitable hard rock or shale formations. Conventional aboveground storage is expensive but has the advantage of flexibility as to location and lends itself much better to quality control.

Figs. 2, 3, 4, 5, and 6 show typical storage facilities of several types mentioned above.

Equipment at Origin

Other than pressure storage, no special equipment is required at the originating pump station. However, where propane is batched with other products of lower vapor pressure, the feeder or station booster pumps must have sufficient head to overcome the vapor pressure of propane at the highest temperature at which it will be fed to the originating station. (A typical commercial propane has an N.G.A.A. vapor pressure of 85 psi. at 50° F. and 190 psi. at 100° F.) Normally it is necessary to have a high head pump only for the products which will displace propane in the feeding cycle. For example, if butane is always used as a buffer for propane, the butane feeder pump should have a head sufficient to overcome the vapor pressure of the propane Similarly, the feeder pump handling material following butane must have a head sufficient to overcome the butane vapor pressure.

Pumping Characteristics of Propane

Propane requires moderate pressure to maintain it as liquid in the line. Depending upon the upstream profile and the temperature of the pumpage, station intake must increase as propane approaches.

Overcoming propane vapor pressure . . . A table can be prepared setting out the minimum intake pressure for various temperatures. If the vapor pressure of the propane is likely to vary slightly, due to its composition, an allowance must be made to be on the safe side.

Another method is to install a propane vapor-pressure tester at each pump station. A simple, but effective and inexpensive assembly, for determining the approximate vapor pressure of the product passing the station is shown in Fig. 7 and is operated as follows:

The station operator first receives the head end of the propane slug at some predetermined pressure which would be on the high, or safe, side. The operator can then find the minimum allowable intake pressure by these steps:

1. Open the expansion valve wide open and note the temperature on the dial thermometer.
2. Check the pressure gage against the station suction pressure to be sure the gages are in reasonable agreement.
3. Throttle the expansion valve, reducing the pressure on the gage by 5-psi. steps, noting the temperature at each step.
4. When the temperature starts to drop, vaporization is taking place. Note the pressure on the gage and then operate with an intake pressure about 20 psi. greater.

Highly compressible . . . Propane is highly compressible. At 60° F., a pressure change of 1,000 psi. will compress it approximately 4 per cent, as compared to less than 1 per cent for products in the motor-fuel range. On a loaded or fully packed line, this compressibility, while troublesome from a metering and measuring standpoint, is beneficial from a safety standpoint in that the propane slug serves as a resilient element in the stream and tends to reduce shock in case of sudden horsepower loss or in case of a valve being closed suddenly against flow.

Low specific gravity . . . Because of its low specific gravity, centrifugal pumps operating on propane produce less differential than is the case with heavier products. In case of variable-speed prime movers, this loss of differential can be partially compen-

The author says . . .

. . . Considerable interest is presently being manifested in handling L.P.G. in pipelines, undoubtedly as a result of the recent immense increase in L.P.G. marketing. (Volume has doubled in the last 6 years and reached approximately 7 billion gallons in 1956).

- Phillips has been pipelining butane for 25 years and propane for 10 years. No particular pumping problems were encountered except that it was necessary to convert to mechanical seals to pump propane. It is necessary to carry higher pump intake pressures to overcome the high vapor pressure of propane. This, coupled with low specific gravity, causes a slight loss in pipeline rates.
- When pumping L.P.G. through the same lines with distillates, especially if internal scale exists, care must be taken to provide suitable buffers to prevent contamination.
- Tankage should be furnished by the shipper. If the pipeline has to furnish storage, the tariffs would be higher to pay for this expensive storage. Underground storage in caverns developed in salt strata or mined in suitable limestone or shale can be used. However, some aboveground, steel storage is usually needed.
- Some additional precautions are needed when repairing leaks in the presence of L.P.G. Considering all factors, we consider propane offers no serious operating problems and is no more hazardous to handle than other products in a pipeline.

MECHANICAL SEAL for main-line centrifugal pump, shown in both assembled and exploded views. Figs. 8 and 9.

sated for by operating the prime mover at increased speed while propane is passing the station. A pipeline system with motor-driven centrifugal pumps will suffer some drop in throughput when pumping propane. This drop in throughput results from lowered pump differential and the necessity of holding high intake pressures. This deration will vary with slug size, station spacing, number and location of intermediate bleedoff terminals, etc., but will be less than deration from the distillates.

Buffering Practices—Contamination

It has been our experience that the internal condition of the pipeline bears an important relationship to the amount of contamination which can be expected while pumping L.P.G. We are speaking of contamination in the sense of very small quantities of contamination extending completely through, or largely through, an entire batch of propane or butane rather than the usual interface of a comparatively few barrels normally experienced between products.

Slug contamination . . . This so-called "slug contamination" must be considered because of rigid residue specifications. The interior of our 6-in. Borger-Denver pipeline, laid in 1947, is known to be almost completely free of internal corrosion. This is because the line has been continually dehydrated and the "C" factor has remained equal to the original new pipe value. On this line we are able to pump comparatively small slugs of propane, buffered by only a few barrels of butane, along with heavier products such as stove oil and furnace oil, approximately 355 miles to Denver and deliver on-specification propane at our Denver terminal.

On our Borger-Chicago line we have a somewhat different condition. The greater part of this system consists of pipe 18 to 26 years old which was not adequately protected internally and is known to be rather heavily scaled. The Borger-Chicago system actually consists of two parallel pipelines with common pumping stations and here we have found it desirable to limit L.P.G. pumpings to one line and to pump the distillates in the other line. Natural gasoline, motor fuel, aviation gasoline, and motor-fuel base, however, are pumped in either line.

Large buffers required . . . It has been our experience that with a heavily scaled line, the oils tend to remain in the scale and are released into the L.P.G. as slug contamination extending through all, or a large part, of the L.P.G. batches which follow. In cases where it has been necessary to pump L.P.G. through the internally scaled pipe, large buffers of natural gasoline were pumped ahead of the L.P.G. batch; however, it is recognized that many pipeline carriers will not have available such large slugs of natural gasoline to serve as a washing agent ahead of the L.P.G. slug.

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Disposal of interface . . . In a system handling all finished products, as opposed to a system handling blending stocks and completing the blending at the terminals, there is a problem of disposal of the motor fuel-butane interface and the butane-propane interface. If the motor fuel is delivered to the carrier at maximum volatility, no butane blending can be tolerated at the terminaling point. Therefore, unless the shipper is in a position to furnish occasionally a subspecification motor fuel, it is not possible to blend off the motor fuel-butane interface and it must be otherwise disposed of. The butane-propane interface can generally be sold as a mix, if it is on-specification otherwise.

By keeping the distillates out of the line handling L.P.G. and by proper buffering, we have found it possible to deliver on-specification

PROPANE LEAK AREA. The men are standing on an ice crust approximately 12 in. thick and 150 ft. in diameter. Heavy bulldozer was unable to cut through this ice crust. Fig. 10.

propane at all of our intermediate terminals between Borger, Tex., and Kankakee, Ill. The most remote intermediate terminal is 680 miles from origin and to date we have had no trouble in successfully taking off heart cuts of specification products after transporting propane through 8, 10, and 12-in. pipe.

Special Safety Equipment

For safe operation in pumping a highly volatile product such as propane, mechanical seals are strongly recommended for all main-line centrifugal pumps.

Packing trouble . . . On our Borger-Chicago system, which uses centrifugal pumps exclusively, failure of conventional lead and graphite ring packing when pumping butane was a source of constant trouble and was a real hazard when the packing failed. After some experimenting we found that the use of force-feed lubricators to feed lubricating oil under pressure to a lantern gland placed in the middle of the seal ring assembly, largely reduced packing-ring failure and sharply reduced gland leakage. However, when it became necessary to transport propane on the Borger-Chicago line in 1952, it was found that this method of packing lubrication was not at all satisfactory and packing failure was too frequent to be tolerated.

Mechanical seals . . . Fortunately, at about that time, a research and testing program, sponsored jointly by one of the major products pipeline companies, two pump manufacturers, and several manufacturers of mechanical seals, had resulted in the near perfection of a partially balanced mechanical seal which would hold propane at the pressures (1,100-1,200 psi.) at which our line was operating.

After pumping one slug of propane from Texas to Illinois, we concluded the operation was too hazardous with pumps equipped with conventional lead-graphite packing. We immediately began installing mechanical seals and until the mechanical seals were installed, propane slugs were reduced in size and stations were shut down while propane was passing. (See Figs. 8 and 9).

Aboveground equipment . . . The pipeline carrier may or may not own or control aboveground storage for propane. However, as a matter of safety, it is recommended that all aboveground storage of this type be equipped with remotely controlled internal valves. These valves can be closed in event of emergency from a remote location.

Blow-down line . . . Occasionally it will be necessary to take a main line unit off the line while propane is passing the station. If it is necessary to work on the pump, the product trapped in the pump and the pump leads must be removed. We have found it desirable to equip each pump in propane service with a blow-down line extending to a riser which is a safe distance from ignition sources. Since each gallon of propane will convert to approximately 36 cu. ft. of vapor, it can be readily seen that without such equipment the handling of such a large volume of vapors would create a problem.

Phillips Pipe Line Co. has published a special tariff for the transportation of propane. This tariff provides the same rate as for other products, but specifies that the shippers will provide all storage and related facilities for handling propane at origin and destination. It also provides a 2 per cent loss allowance for the benefit of the carrier. Because of the high cost of pressure storage, it would be necessary that this cost be reflected in tariff rates if the carrier furnished such storage.

Although, as mentioned previously, we have handled some 17 million barrels of propane in the past 9 years through systems containing pipe part of which has been in the ground since 1931, our leak experience has been reasonably good. The only two potentially hazardous leaks we have experienced were not caused by failure of the pipe due to corrosion, but by road-working equipment cutting the line.

We have had only one major pipe failure charged to corrosion while propane was in the section, and this failure occurred in a remote area. We have never had a fire or explosion on our pipeline system caused by propane. This includes not only the transportation phase, but also all other handling such as storage and loading at terminals. Actually, with suitable equipment and proper handling, we feel propane offers no more hazard in the pipeline and less hazard at terminals than other products.

Leak-Repair Practice—Propane and Butane

Unless it occurs in an area where even minor escape of vapors creates a hazard, it has been found desirable, in the case of a small leak occurring in a section containing butane or propane, to pump the product by the leak area and make repairs when a less volatile product is passing. This is because the ground at the leak location is invariably frozen from the cooling involved in evaporating the leaking propane or butane and uncovering the pipe is difficult, slow and somewhat hazafdous. (See Fig. 10.)

Large leaks . . . These of course, require a shutdown, but this does not stop escape of product. Generally, in case of a large leak, the only recourse is to shut down, eliminate all possible sources of ignition, move people out of the area and close all roads in the area. Of course, any block valve on each side of the leak area should be closed as soon as possible. If there is considerable distance between block valves, the hazard in the leak area can be reduced by tapping the line at a safe location between the blocked valves and flaring the product. Also, if a water source is available, water may be introduced upstream of the leak and pumped until the volatile material is pushed past the downstream block valve. If the leak is large enough, all of the volatile material will have escaped before anything can be done.

Since, as mentioned before, the ground will be frozen in the leak area, we have found it advisable, in order to reduce downtime, to stock pipe and the necessary fittings at strategic locations along the system so we can cut in and lay a temporary line around the leak location without waiting for the line cover to thaw.

Perhaps the most troublesome type of leak is one which is too large to allow pumping by to a less-volatile following product and yet not so large but that many hours, or even days, would be required for the product to vent itself between any valve closures which might be effected. For leaks in this category, tapping and plugging machines may be used to confine the product loss to a relatively small section of the line. While we have had no occasion to use this equipment under emergency conditions, we have experimented with two well-known makes of tapping and plugging equipment, and have found that both are effective in blocking off propane under moderate pressure, i.e., the plugging equipment will hold the vapor pressure of the propane, plus a reasonable static head.

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SHELTERED OUTSIDE installation of gasoline plant control panels. Fig. 1.

MINIATURE control panel for gasoline-plant service. Fig. 2.

Instrumentation Advances on Five Fronts

"... we are in the unusual position of being able to utilize the vast experience of our refining brother in determining how these new developments can best be adapted to our operations. However, we cannot depend on them for all the answers. Many can be obtained only through our own direct experience."

by Robert R. Click

WITHIN the past 10 years there have been five significant developments in continuous production process instrumentation. These are:

1. The use of pneumatic or electrical transmission between the measuring element and the recorder or controller.
2. The advent of small-size recorder-controller combinations, commonly referred to as miniatures.
3. Increased use of electronics control.
4. Development of techniques and equipment for the continuous analysis of process streams.
5. Automatic scanning and logging of process data.

The fourth item listed, continuous analysis of process streams is covered elsewhere and is therefore outside the scope of this paper.

Author is with Magnolia Petroleum Co., natural-gas department at Dallas. Paper presented at thirty-sixth annual convention of N.G.A.A. at Houston, April 24-26, 1957.

Field Processing

At present there appears to be little or no incentive for applying item 5, automatic data handling, to gasoline-plant operation because of (1) high cost and (2) the limited volume of data usually handled in a field-processing plant. Scanning and logging might prove economical for unattended operation where an elaborate alarm and shutdown system would be required, but in the interest of time it will be omitted from this discussion.

So we will consider the remaining three items: transmission, miniatures, and electronics. Each of these has received much wider use in refinery and chemical plant operations than in the natural gasoline plant, and for good reason. Problems associated with large-scale plants, such as refineries, led to their development.

These same problems are present either to a lesser degree, or not at all, in most gasoline plants. Yet, people outside the industry are prone to criticize our failure to adopt these methods completely. I do not believe we should be sensitive to such criticism. On the other hand, we should not pass off new developments with a first-glance conclusion that they do not fit our needs. Each should be weighed carefully with respect to performance, maintenance, and cost. We should adopt those things which are really worthwhile. Anything which has no valid economic justification, no matter how "modern" it might be, should be avoided. The only way in which we should try to "keep up with the Joneses" is in safe, efficient, operations.

Gasoline plants vary greatly in size, complexity, and environment. No firm rules on instrumentation can be drawn which will apply in every case. I certainly do not intend to suggest any here, but I will attempt to outline some of the factors to be considered.

Transmission

Before a pressure, flow, or temperature can be controlled, it must be measured. At one time the measuring element and the controller were directly connected. On flow, for in-

stance, the differential sensing element was located on the back of the controller case, with connecting lines to the orifice taps.

Central control room . . . As plants grew larger and grouping of instruments and centralized control came into being, the controller location moved farther and farther away from the point of measurement. This created two problems. First, the time lag between the measuring point and the controller became excessive, disrupting performance of the control system, and second, from a safety standpoint it was undesirable to bring hydrocarbon lines into the control rooms. These problems led to development of devices, located at the point of measurement, which could transmit the measured value to the controller in terms of a pneumatic or electrical signal. Such transmitting devices have for several years been available for all of the common control variables. They have been widely, though by no means universally, used in gasoline plants.

Local grouping . . . Many gasoline plants utilize locally grouped instrument arrangement in sheltered, but not enclosed locations. Fig. 1 illustrates this arrangement. Distances between the point of measurement and the controller are, in general, not great enough to seriously affect the direct-connected controller, particularly where localized grouping of instruments is employed. Thus, we might maintain that general use of transmission is not necessary or desirable in the gasoline plant.

However, this does not tell the whole story. There have been side developments in transmission which can be extremely important to our operations, even where short distance and outside mounting are employed.

Performance . . . From process industries in general, at least those where control performance is critical, there is a considerably greater demand for transmission systems than for direct-connected instruments. The instrument manufacturer's development effort is directed accordingly. New features have been incorporated in the design of transmission instruments which are not available in the direct-connected types. The most significant of these are: (1) faster response of the measuring element itself, (2) narrow range spans, and (3) flexibility in range-span adjustment.

Temperature range spans of 50° F. and pressure spans of 20 psi. are available as standard items and are adjustable within rather broad limits without changing parts. These narrow spans give the effect of magnifying the measurement record, allowing more precise control. As an example, take a fired-heater temperature control, operating at 500° F. A direct connected controller on this service would probably use a range span of 0°-600° F. A pen movement of 0.1 in. would represent about a 15° F. change in temperature. Using a temperature transmitter with a 50° F. span set for 475°-525° F., this same pen movement would represent a temperature variation of slightly over 1°.

Cost . . . Table 1 shows a cost comparison between single-pen direct-connected and transmission system controls for pressure, temperature, and flow. These costs do not include installation. For pressure and temperature applications the installation costs would probably be somewhat higher for the transmission system, primarily because of the necessity of piping an air-supply line to the transmitter. On flow applications installation costs would generally favor the transmission system, particularly where seals would be required for a manometer type of meter. A force-balanced flow transmitter could be sealed without the use of pots because its volumetric displacement is extremely small. Thus, for the usual gasoline-plant application, pressure and temperature transmission systems are more costly than their direct-connected counterparts, while flow-transmission systems, including installation, compare favorably in cost with direct-connected manometers.

Maintenance . . . Transmission systems, in general, have given excellent service from a maintenance standpoint. While on pressure and temperature applications an extra instrument is involved when using transmission, I do not believe that maintenance considerations offer any deterrent to their use. On the other hand, for flow applications, particularly where seals are required, maintenance reduction is a significant point in favor of transmission.

TABLE 1—PNEUMATIC INSTRUMENT COSTS

	Rectangular case direct connected pneumatic	Rectangular case pneumatic with transmitter	Miniature pneumatic with transmitter
Temperature	*$675	*$750	$770
Pressure	*480	*700	720
Flow	*620	*730	750

*Price includes $50 for optional four-position automatic-manual switching unit.

My own company has made increasing use of transmission systems in gasoline-plant applications in recent years. Experience with these systems has convinced me that they are well worth while because of their advantages of:

1. Faster measurement response.
2. Standard narrow range spans.
3. Flexibility in range-span adjustment.
4. Increased reliability and reduced maintenance on flow applications, particularly where sealing is required.

Their sole disadvantage is cost, and while this factor should not be ignored any investment savings should be weighed carefully against sacrifice in control system performance.

Miniature Instruments

Miniature instruments have evolved from two problems prevalent in large-size plants. These are, (1) control boards so long that the operator is hampered in following process operations, and (2) the high cost of providing control-room housing for these large boards. In many cases, space availability is an important factor. Miniature recorders, approximately 4 by 4 in. in size, have almost entirely replaced rectangular case instruments where these considerations are present.

Fig. 2 shows a console-type miniature panel for gasoline-plant service. Rectangular case instruments are approximately 14 by 18 in. in size, and require three to four times the running length of control board occupied by the same number of miniature instruments with conventional arrangement. Compact pneumatic control units have been developed for the miniature component systems. These controllers can either be mounted at the control valve where transmission lags are significant, or "plugged" into the recorder unit back of the panel board. The significance of the "plug-in" feature is twofold. First, it means that components are easily interchangeable, and second, either the recorder or the controller can be quickly removed from the panel and taken to a shop for calibration or repair without disturbing the other components of the system.

Two-pen integrators are not available for static and differential integration of miniature strip charts. Where such charts are used for gas-accounting purposes they must either be sight read or the circular chart recorder retained. Single-pen integration is available for strip charts, using integrators specifically designed for the purpose.

Performance . . . As with transmission, market demand has centered the

manufacturer's development on miniature-type instruments. As a result, new features have continually been incorporated into miniature-instrument design while rectangular case instruments have remained basically unchanged in recent years. Rectangulars will probably not see a significant amount of additional development. When better controllers are built, they will be of the minature type. Even present-day miniature instruments will do things that a rectangular case instrument cannot. For instance, they offer a wider range of adjustment in controller settings; they incorporate important modifications in the interrelationship of the control (proportional, reset, and derivative) responses.

In general, they use higher-capacity relays than the rectangular type, meaning that they are faster acting. These performance features might be difficult to evaluate on most present-day gasoline-plant applications. Rectangular case controllers do a good job, particularly where transmission is used. On really difficult services, the miniature instrument will undoubtedly exhibit superior performance. But performance which you do not need or use is worthless. Performance utilization will be discussed in more detail later on.

Cost . . . With miniature instruments, use of transmission is mandatory. They also incorporate four-position automatic to manual switches as a standard feature. Both of these are optional with the rectangular case type. Where transmission and automatic-to-manual units are employed with rectangular case instruments the cost (of the instruments themselves) is comparable with the miniature type, as shown in Table 1. Without transmission and A.-M. units rectangular instruments are less expensive.

Another factor affecting cost is the combination of more than one controller in a single case. With miniatures, a maximum of one controlling and one recording pen are available in a single recording unit; two controllers cannot be combined. With the rectangular type, two controllers with proportional and reset action can easily be incorporated into a single case, giving a saving in both direct instrument cost and panel-board requirement.

While combination of rectangular controllers can reduce instrument cost below miniatures, such reduction in number would probably not erase the miniature's advantage in panel-board cost. Two price quotations on panel boards, with the instruments mounted and piped to panel-board terminals reflected a saving of about $1,000 when 20 single-pen miniature instruments were compared with the same number of the rectangular case type.

Thus, you can see that there are numerous combinations of conditions which will affect a cost comparison between miniature and rectangular case instruments. Only where expensive control-room space becomes a factor can miniatures show a clear cost advantage. On the other hand, only where direct-connected controllers are employed with outside panels does the cost balance shift the other way. The great majority of gasoline-plant applications will, I believe, fall in between these two extremes. As such, each must be evaluated separately to achieve an accurate cost comparison, and in most of these, cost would probably not be the predominant deciding factor.

Maintenance . . . I have discussed maintenance experience with several users and vendors of miniature instruments. They appear to have given good service in the few years they have been used. The only complaint which I heard with any regularity was initial experience with pneumatic chart drives. Miniatures are available with either pneumatic or electric chart drives. The electric chart drives have proved reliable, but are not explosionproof, and can be used only in a nonhazardous area or in a control room classed as nonhazardous.

As a result, all gasoline-plant miniatures with which I am familiar, and many refinery installations, have been installed with pneumatic drives. Initially, there was considerable trouble with these units due to chart stoppage and tearing. There were also inking problems, probably caused largely by chart-drive failures, and certainly aggravated by them. The manufacturers with whom I have discussed this problem have indicated that any significant chart-drive and inking problems they might have had have been corrected through improvements in design.

Users generally agree with this claim, but some question the reliability of pneumatic drives where the air supply is not of top quality from the standpoint of being dirt, oil, and moisture-free. Miniatures have several advantages in maintenance ease, primarily their plug-in construction and interchangeability. This means that repairs can be made in the shop, and that spare-parts stocks can be reduced through use of spares rather than individual parts. While it was not mentioned, parts-stock cost is certainly a factor in the economic considerations of instrument selection.

In short, I believe that a user of minature instruments during the last 5 years would have received quite satisfactory over-all operation, but would probably have experienced more nuisance-type problems than with a comparable rectangular case installation. This is to be expected with any new concept of design. It is a temporary condition, and in the case of miniatures has probably already been largely overcome.

In general, then, miniatures have the following advantages over rectangular case instruments:

1. Smaller panel-board space requirements, reduced board cost and, where used, less control-room space.
2. They offer the latest in control circuit design, wider range of settings, and higher-capacity relays than rectangular case type.
3. Components are interchangeable from one system to another.
4. The units may be removed for shop maintenance.

Their disadvantages:

1. No integrator is available for static and differential integration of gas flow charts.
2. Cost is higher than direct-connected rectangular case controllers.
3. Electric chart drives not available in explosionproof construction.

Pneumatic or Electronic?

The subject of pneumatic vs. electronic control has been debated hotly in the past 5 years. A significant number of electronic systems have been installed in refineries and chemical plants. Again, the main basis for argument in favor of electronics, effective control where long distances are involved, is not as prevalent in the gasoline plant as it is in the refinery. And, while this does not rule out electronics for use in the gasoline plant, it does require approaching the question from a somewhat different angle.

Proponents of electronic control systems claim for them superior performance, maintenance-free operation, and installed cost comparable to, or less than, pneumatics.

Performance . . . There are many facets to the electronic-pneumatic performance controversy. First, any comparison in performance should be based on the latest available equipment of each type. This means pneumatic force-balanced transmitters and controllers compared with the newest electronic systems. On this basis, advocates of pneumatic systems concede nothing in the way of performance where moderate transmission distances are involved. The term "moderate transmission distances" can be somewhat misleading, but I believe it would include the vast majority of applica-

tions found in the gasoline plant.

Cost . . . The total cost of components for an electronic control system is somewhat higher than for a comparable pneumatic arrangement. Also, only single-pen controllers are available in the electronic lines, which would undoubtedly mean a larger number of panel instruments. There is no electronic counterpart for the pilot-type pneumatic controller used so widely in the gasoline plant, and as long as such a condition exists, these applications would probably remain pneumatic even if electronic instruments were used on board mounted controller applications.

The claim of comparable or lower **installed** cost for electronics is based primarily on savings in wiring compared to running pneumatic tubing. This may very well be the case where there are long runs of multiple line installations or where distance dictates mounting the controller at the valve (four air lines are required compared to two when the controller is at the board).

Distance does not affect operation of the electronic controller, so it can always be board mounted. But in the gasoline plant, even with centralized control, the number and length of multiple runs is limited, whereas there are a great many individual lines. Under these conditions I do not believe that wiring, with conduit, can compete costwise with tubing installations.

Another consideration is control-room cost. While electronic transmission units are available in explosion-proof construction, the recorders and controllers are not. This requires that control-room location or construction be such that it be classified as a non-hazardous area. This is likely to be a significant factor, if not in cost of the room itself, in the length of connecting lines. There appears to be no reason why localized grouping of the instruments in sheltered locations would not be possible with electronics, but the necessity of location outside the hazardous area would erase the benefits of this arrangement. Therefore, centralized control, with its inherently higher cost, would appear to be the only logical arrangement with electronic control.

Air system costs are also a factor. With an all-electronic system, instrument air would not be required. This could represent a significant savings. However, for valve operation and pilot control applications, pneumatic operation seems desirable even where electronic systems are used. While mass production might make electro-hydraulic or electric-valve operators competitive in price with pneumatic designs, and there is considerable question that it will, those that are now available are considerably higher, a price differential much greater than any which have been shown for the controller components themselves. So for the present, at least, no significant savings in instrument air costs are apparent.

In short, I do not believe that for today's general gasoline-plant application, electronic controls can compete in cost with comparable pneumatic systems. If they gain acceptance, it will be because of performance or maintenance considerations.

Maintenance . . . Several maintenance advantages are claimed for electronics, namely, absence of instrument air problems with moisture, dirt, and pneumatic tubing leakage; the absence of moving parts; unitized construction to minimize spare-parts stocks and allow repairs to be made in the shop.

The pneumatic school of thought counters these arguments in maintaining that instrument air problems, while important, can and should be avoided through proper equipment selection and system design; that electronic systems are inherently more complex than pneumatic ones; that any system using vacuum tubes cannot claim trouble-free operation; and that parts stocks are higher for electronics because a greater amount of replacement-type maintenance is required.

One point relating to maintenance is worth considering from a gasoline-plant point of view; the number and caliber of maintenance personnel. Most gasoline plants do not have instrument maintenance staffs. The usual case is a single instrument repairman. So long as complete electronic systems are impractical, such a repairman would have to be competent in both electronic and pneumatic operations, if electronic instruments were used. This might be an important point in some instance.

There are some other factors in the pneumatic-electronic question which should be pointed out. Electronics offer the advantage of:

1. Better adaptability to process monitoring and analysis systems.

2. Adaptability to greater number of applications, such as conductivity and pH, than are pneumatics.

Electronics have the disadvantage of:

1. Lack of standardization in electronic signal ranges, meaning that components cannot be readily interchanged from one manufacturer's system to another. The 3-15-psi. signal range is almost universal in pneumatic systems.

2. Power failure means instantaneous loss of control action with electronics unless expensive standby power generating equipment is provided. With pneumatics, the stored air supply will allow controls to operate for some length of time, and adequate emergency make-up is usually easier to provide.

Utilization of Control-System Performance

Much has been said about the importance of control-system performance. But you may recall my statement that performance which you do not need or use is worthless. I would like to stress that you do not have to have "double-tough" control problems to be able to utilize a top-performance control system. Even on the double-tough applications, instrumentation can be made easy if enough cushion is built into the process system. There is a happy balance between designing the control system to fit the process and designing the process to fit control performance.

As better control systems become available, we **should be able to reduce costs on such items as surge capacities and safety factors in tower efficiencies. These savings can be many times the increased cost of instrumentation.** One other point regarding controller performance—no amount of investment in instrumentation can give good operation unless it is properly applied to control the right variable, at the right point, in the right way.

As I said at the beginning, there are no pat answers to the items which have been discussed. For instance, many of the advantages, disadvantages, and costs which have been outlined could change almost overnight through design modifications or improved manufacturing methods.

I believe that, as an industry within an industry, we are in the unusual position of being able to utilize the vast experience of our refining brother in determining how these new developments can best be adapted to our operations. However, we cannot depend on them for all the answers. Many can only be obtained through our own direct experience.

Where necessity for change does not exist, the wait and see approach has its merits. But he who waits forever, or who is satisfied to merely get by in instrumentation will pay, in the long run, through failure to recognize those instances where a dollar invested in better controls can return him 10 dollars in over-all plant construction costs, or 20 dollars in reduced operating expense, or 100 dollars through more efficient operation. **End.**

New equilibrium data on

Sweetening Natural Gas With Ethanolamine Solutions

by H. G. Muhlbauer and P. R. Monaghan

THE objective in undertaking this work was to develop data which could be used in the accurate design of gas-treating plants and in the proper operation of these plants. It is our belief that such data will allow more economic construction and more nearly optimum operation. Further benefits may be realized through reduction in corrosion.

Existing Data

The classic equilibrium data for carbon dioxide-aqueous ethanolamine systems are given by Mason and Dodge.[1] These cover the temperature range of 25° to 75° C., ethanolamine normalities of 0.5 to 12.5 and carbon dioxide partial pressures of 10 to 760 mm. Hg. The range of these systems, with respect to carbon dioxide partial pressure, was extended by Schneerson et al.,[2,3] Lyudkovskaya et al.,[4] and Atadan[5] to as high as 40 atm. Reed and Wood[6] give some data for the carbon dioxide-aqueous monoethanolamine and carbon dioxide-aqueous diethanolamine systems in the range of 100° to 140° C. Rate-transfer data are also presented in References 2 to 6.

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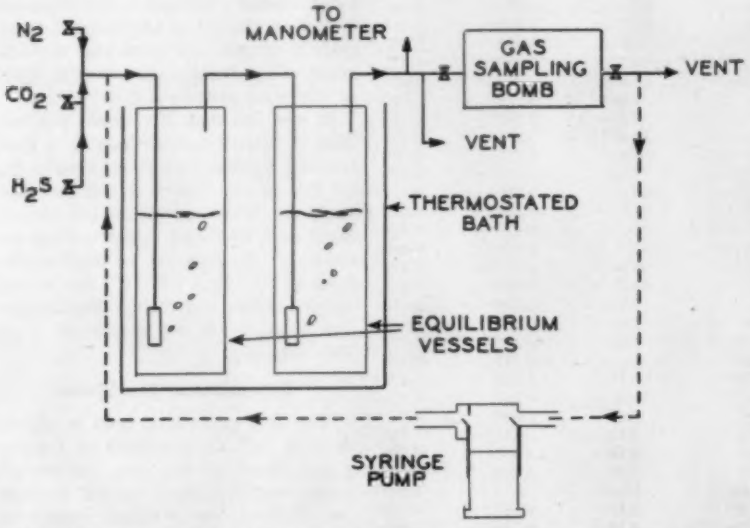
H_2S-ethanolamines systems . . . Much less information on the hydrogen sulfide - ethanolamines system has been published. Riegger, Tartar and Lingafelter[7] investigated the hydrogen sulfide-aqueous monoethanolamine system in the range of 25° to 60° C., monoethanolamine normality of 0.6 to 5.0 and hydrogen sulfide partial pressure of 25 to 700 mm. Hg.

Leibush and Schneerson[8] extended this and the hydrogen sulfide-aqueous diethanolamine system with data down to hydrogen sulfide partial pressures of 0.1 mm. Hg. In addition, they presented the only data available for simultaneous solubilities of hydrogen sulfide and carbon dioxide in aqueous ethanolamine solutions. These data consist of a few scattered points which are insufficient to define the system. But they do serve to indicate the profound effect that the presence of hydrogen sulfide has on lowering the carbon dioxide solubility and vice versa.



SCHEMATIC DRAWING of laboratory equipment for obtaining equilibrium data at 25° C. Fig. 1.

CO_2 effect . . . The extent of the effect of CO_2 on the solubility of H_2S in monoethanolamine solutions is apparent from the data of Leibush and Schneerson. As an example, the partial pressure of H_2S over a solution containing 0.262 moles H_2S/mole MEA and no CO_2 is 1.9 mm. Hg. When CO_2 is introduced into this solution to the extent of 0.385 moles CO_2/mole MEA, the partial pressure of H_2S is raised to 70 mm. Hg although no H_2S has been added to liquid. This is a 37-fold increase.

Overdesign and Underdesign

Since most sour natural gas contains both H_2S and CO_2 this phenomena was of general importance to the industry. In designing a plant to treat gas to ¼ grain of H_2S per hundred cubic feet it was essential to take this effect into account. However, with complete and accurate data lacking, this taking - into - account amounted to rough approximation, generally based on prior experience. This practice has led to excessive overdesign in some cases, and underdesign in others.

Of the two evils, overdesign is generally the lesser, for while it results in construction of a plant whose capital investment is higher than necessary, it will treat the gas.

By far, the more-serious case is that of underdesign. To treat the rated amount of gas to specification, the solution circulating rate must be raised to such a high level that tower flooding is experienced in the contactor, or incomplete stripping occurs (possibly both) so that operations are always on the ragged edge.

In some cases, these limitations occur well below the rated gas capacity of the tower so that plants have operated at substantially less than design load.

Corrosion . . . In addition to the difficulties of operation resulting from improper design, corrosion may also result. This evil is not necessarily a function of design versus operating rates, although it can be. For example, underestimation of the amount of acid gas which a solution will absorb,

or the solution loading in design, may require higher than design circulating rates to avoid overloading of solution and consequent possibility of corrosion in transfer lines and exchangers. By overloading the solution is meant the absorption of acid gas in amounts exceeding 30 cu. ft. per cubic foot of solution. This value generally is considered as the upper safe limit from a corrosion standpoint.

A not-so-apparent possibility for corrosion in heat exchangers exists as the result of underestimating the acid-gas partial pressure at a given solution loading so that, following the point of pressure reduction, the solution would be above its bubble-point temperature. It would release free H_2S and CO_2. Corrosion of mild steel will normally occur under such conditions.

The primary concern in this work, however, was the development of accurate data for gas sweetening rather than correcting corrosion.

TABLE 1—SOLUBILITY OF HYDROGEN SULFIDE AND CARBON DIOXIDE IN 2.5 N AQUEOUS MONOETHANOLAMINE AT 25° C.

Point No.	MEA conc., moles/liter	Partial pressure, mm. Hg		Liquid conc., mole/mole MEA	
		H_2S	CO_2	H_2S	CO_2
1	2.42	306	0	0.934	0
2	2.42	165.2	0	0.913	0
3	2.42	111	0	0.866	0
4	2.45	53.2	0	0.786	0
5	2.46	31.0	0	0.706	0
6	2.41	720	0	0.939	0
7	2.44	16.5	0	0.597	0
8	2.47	7.67	0	0.450	0
9	2.49	1.26	0	0.272	0
10	2.50	0.99	0	0.196	0
11	2.50	3.37	0	0.323	0
12	2.52	0	715	0	0.740
13	2.52	0	527	0	0.720
14	2.53	0	214	0	0.656
15	2.53	0	100.9	0	0.603
16	2.54	0	63.6	0	0.585
17	2.54	0	28.8	0	0.554
18	2.59	0	6.24	0	0.494
19	2.54	0	3.74	0	0.494
20	2.54	0	0.97	0	0.460
21	2.47	711	20.4	0.820	0.108
22	2.49	342	19.6	0.614	0.167
23	2.51	52.2	1.13	0.488	0.172
24	2.52	17.4	0.29	0.384	0.165
25	2.53	7.8	0.34	0.284	0.172
27	2.52	330	62.4	0.403	0.280
27C	2.53	142	19.9	0.364	0.286
28	2.52	93.8	11.4	0.336	0.292
29	2.53	29.2	2.27	0.256	0.290
30	2.55	10.9	0.78	0.185	0.296
31	2.54	4.15	0.47	0.120	0.302
32	2.55	1.81	0.36	0.074	0.304
33	2.56	0.82	0.24	0.038	0.309
34	2.60	6.0	0.60	0.155	0.286
35	2.62	13.9	2.6	0.134	0.346
36	2.63	8.3	1.70	0.112	0.352
37	2.62	4.8	1.06	0.090	0.356
38	2.63	1.88	0.70	0.066	0.348
39	2.62	1.27	0.40	0.043	0.347
40	2.60	0.48	0.52	0.022	0.333
41	2.56	59.5	34.1	0.142	0.410
42	2.58	47.6	47.5	0.098	0.430
43	2.58	28.0	33.5	0.075	0.447
44	2.59	17.3	24.4	0.057	0.445
45	2.59	9.28	19.5	0.036	0.472
46	2.59	3.38	13.0	0.019	0.487
47	2.52	68.6	8.61	0.289	0.307
48	2.52	166.2	55.4	0.266	0.357
49	2.53	92.7	32.4	0.234	0.364
50	2.53	55.6	13.8	0.214	0.358
51	2.54	30.4	7.50	0.171	0.357
52	2.53	340	94.2	0.383	0.317
53	2.56	230	83.8	0.300	0.350
54	2.61	172	157	0.170	0.456
55	2.61	109.4	104	0.138	0.460
56	2.62	65.2	66.8	0.117	0.471
57	2.63	38.7	49.2	0.092	0.464
58	2.49	163	9.31	0.556	0.181
59	2.52	36.0	1.06	0.451	0.180
60	2.53	4.23	0.23	0.220	0.175
61	2.53	1.94	0.21	0.146	0.174
62	2.53	1.18	0.10	0.114	0.174
63	2.49	443	16.0	0.742	0.104
64	2.49	140	2.76	0.684	0.112
65	2.50	52.8	0.82	0.614	0.112
66	2.51	27.0	0.46	0.543	0.098
67	2.51	11.4	0.27	0.449	0.105
68	2.53	7.41	0.31	0.372	0.108
69	2.52	4.40	0.15	0.280	0.104
70	2.53	2.49	0.16	0.226	0.100
72	2.52	0.09	0.16	0.112	0.100
73	2.51	2.23	0	0.308	0

Field Processing

Tower Design

Tower design for both contactor and stripper in amine-gas-sweetening service has been discussed by Reed and Wood.[6] Emphasis was made on gas rates and liquid rates for both bubble-plate and packed towers, and the effect of these rates on tower flooding. No relationship was drawn between solution rates and gas rates for various conditions of acid-gas concentration.

Sherwood and Pigford[11] have dealt rather extensively with the general subject of absorption. This text touches on the amine-acid gas system and the application of design principles to this system.

Variables

In fixing the scope of this work there were four variables to be considered: (1) concentration of monoethanolamine in water, (2) solution temperature, (3) carbon dioxide concentration in the liquid, and (4) hydrogen sulfide concentration in the liquid. It was decided that one monoethanolamine solution concentration would be studied at two temperatures with hydrogen sulfide-carbon dioxide composition being varied over a nearly complete range.

It was felt that this would provide data to describe conditions in a gas-treating contactor and in a stripper. In this work, therefore, an attempt has been made to define completely the system hydrogen sulfide-carbon dioxide-2.5 N aqueous monoethanolamine at 25° and 100° C. and at hydrogen sulfide and carbon dioxide partial pressures in the region of 1 to 700 mm. Hg.

Experimental Procedures

The first procedure used to obtain data at 25° C. consisted of feeding a gas blend of nitrogen, carbon dioxide, and hydrogen sulfide through two 250-ml. gas washing bottles in series. The gas in equilibrium with the second washing bottle passed

through a gas-sampling bomb and was then vented.

A schematic diagram of the apparatus is shown in Fig. 1. The three feed gases were metered into the system at such rates as to closely approximate the composition of the gas phase in equilibrium with the solution in the second bottle. The inlet tubes of the two gas washing bottles had fritted cylinder tips for breaking the gas into tiny bubbles. The bottles were charged with 2.5 N aqueous monoethanolamine solutions which also contained the desired amount of carbon dioxide and hydrogen sulfide in solution. They were placed in a water bath thermostated at 25.0 ± 0.02° C.

TABLE 2—SOLUBILITY OF HYDROGEN SULFIDE AND CARBON DIOXIDE IN 2.5 N AQUEOUS MONOETHANOLAMINE AT 100° C.

Point No.	MEA conc., moles/liter	Partial pressure, mm. Hg		Liquid conc., mole/mole MEA	
		H_2S	CO_2	H_2S	CO_2
1	2.45	90	0	0.248	0
2	2.44	195	0	0.372	0
3	2.44	263	0	0.420	0
4	2.42	420	0	0.491	0
5	2.42	447	0	0.511	0
6	2.41	644	0	0.578	0
7	2.39	952	0	0.660	0
8	2.42	518	0	0.546	0
9	2.40	804	0	0.639	0
10	2.40	899	0	0.649	0
11	2.41	0	759	0	0.490
12	2.40	0	923	0	0.500
13	2.40	0	1,084	0	0.511
14	2.41	0	681	0	0.481
15	2.41	0	593	0	0.472
16	2.41	0	366	0	0.430
17	2.42	0	476	0	0.456
18	2.39	0	285	0	0.405
19	2.41	0	237	0	0.383
22	2.38	947	77.0	0.549	0.076
23	2.40	632	57.1	0.489	0.083
24	2.40	540	52.6	0.453	0.082
25	2.40	403	42.4	0.412	0.081
26	2.37	742	63.0	0.532	0.073
27	2.39	316	28.6	0.381	0.073
28	2.39	224	24.5	0.299	0.075
29	2.39	118	18.1	0.224	0.084
30	2.40	129	49.2	0.177	0.167
31	2.40	228	74.9	0.236	0.168
32	2.39	319	84.5	0.286	0.171
33	2.39	410	109.0	0.326	0.172
34	2.39	564	155	0.375	0.169
35	2.39	760	169	0.422	0.156
36	2.40	833	168	0.444	0.146
37	2.40	964	551	0.342	0.241
38	2.42	638	312	0.306	0.239
39	2.41	700	385	0.308	0.246
40	2.42	466	237	0.275	0.234
41	2.43	360	179	0.252	0.229
42	2.44	219	125	0.187	0.230
43	2.44	136	104.5	0.141	0.244
44	2.44	75.3	90.7	0.093	0.251
45	2.44	239	388	0.139	0.325
46	2.44	111	289	0.079	0.344
47	2.43	241	451	0.126	0.351
48	2.43	269	428	0.144	0.331
49	2.43	373	565	0.169	0.328
50	2.43	397	568	0.177	0.321
51	2.42	545	829	0.193	0.339
52	2.42	470	643	0.191	0.324
53	2.42	525	740	0.198	0.333
54	2.42	324	1,290	0.106	0.422
55	2.42	260	924	0.099	0.408
56	2.43	204	690	0.090	0.398
57	2.44	170	566	0.081	0.385
58	2.45	76.3	500	0.043	0.413
59	2.47	34.4	462	0.023	0.424
60	2.43	123.8	0	0.294	0
63	2.44	24.8	0	0.102	0
64	2.45	9.2	0	0.060	0
65	2.42	151	14.5	0.262	0.074
66	2.44	87	10.3	0.188	0.076
67	2.43	50.7	14.2	0.127	0.072
68	2.44	22.6	9.1	0.075	0.076
69	2.43	139	37.7	0.196	0.153
70	2.44	85.3	30.3	0.146	0.158
71	2.45	60.9	26.1	0.113	0.156
72	2.45	52.5	22.8	0.108	0.155
73	2.45	0	65.6	0	0.300
74	2.46	0	32.6	0	0.244
75	2.46	0	18.7	0	0.200
76	2.45	0	13.4	0	0.165
77	2.45	0	8.1	0	0.136

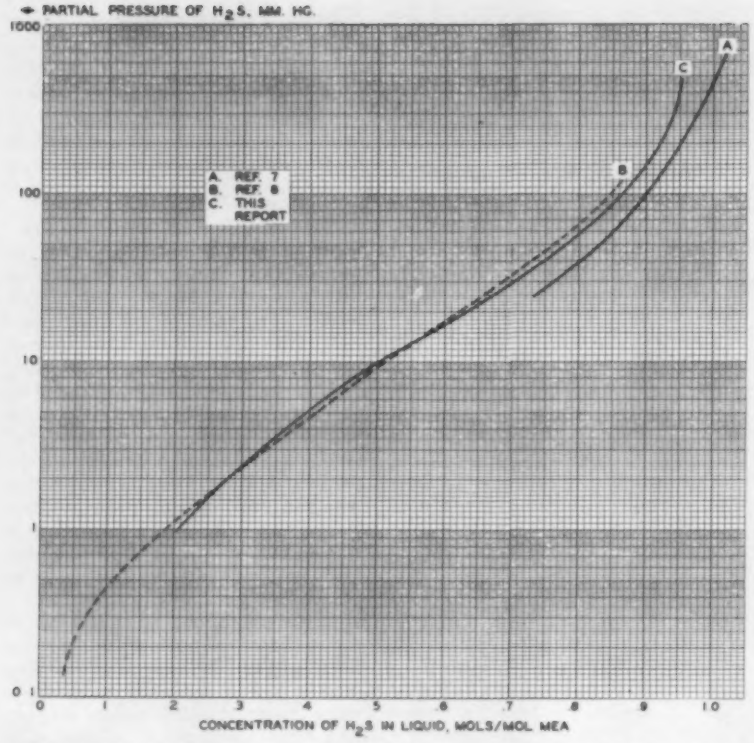
Reaching equilibrium . . . Prior to starting a run, the system was flushed with nitrogen to remove any oxygen present. The rates of the three gases were then adjusted to their desired values, the total flow not exceeding 150 cc. per minute, and permitted to flow until equilibrium between gas and liquid phases was reached. The time required to reach equilibrium depended on how closely the relative gas rates and initial hydrogen sulfide and carbon dioxide concentrations in the liquid phase approximated equilibrium or, more simply, how close to equilibrium the system was initially.

In general, about 4 hours were allowed before sampling of the gas and liquid phases. The gas phase was sampled by merely removing the gas-sampling bomb through which the gas had been continuously passing. The liquid phase was sampled with a hypodermic syringe and long needle via a rubber serum stopper fitted to an opening at the top of the second gas washing bottle. All runs were duplicated as a check on whether equilibrium had been attained.

For equilibrium points in which the sum of hydrogen sulfide and carbon dioxide partial pressures was not expected to exceed about 25 mm. Hg, only nitrogen gas was fed in, and at a much lower rate of about 10 cc. per minute.

Automatic pipetting . . . The above procedure proved satisfactory. However, it was time consuming and difficult to operate. The difficulty lay primarily in keeping the carbon dioxide, hydrogen sulfide, and nitrogen flows constant at a low flow rate. Several types of valves and orifices were tried, but still the system had to be watched carefully for drifts and changes.

A major improvement was effected when it was discovered that the automatic pipetting machine made by Baltimore Biological Laboratory could pump the gas phase from the exit of the gas-sampling bomb back to the inlet of the first gas washing bottle. Under these circumstances, no fresh gas had to be continuously metered in, the first gas washing bottle could be eliminated and equilibrium was attained generally within half an hour. This method operated best with the pressure in the system in the range



EQUILIBRIUM SOLUBILITY of H_2S in 2.5 N monoethanolamine at 25° C. Fig. 2.

of 0 to 100 mm. Hg above atmospheric pressure.

High-temperature procedure . . . Data at the elevated temperature, 100° C., were most easily obtained by equilibrating gas and liquid samples in a closed bomb at the desired temperature. A stainless-steel bomb 3 in. in diameter by 6 in. high was fitted with a 0-30 psi. Bourdon tube laboratory test gage, which was marked in ⅛-psi. subdivisions. Another opening at the top was fitted with a ¼-in. Hoke valve.

The gage was removed from the bomb by disconnecting a union and the bomb was flushed with nitrogen. The bomb was then charged with 300 cc. of 2.5 N monoethanolamine solution containing the desired amount of carbon dioxide and hydrogen sulfide. The gage was then reconnected and the bomb immersed in a diethylene glycol bath thermostated at 100° ± 0.02° C. Approximately 1 hour was allowed for the bomb and its contents to reach thermal equilibrium. During this period the bomb was agitated manually at 10-minute intervals, and vented about three or four times to remove the nitrogen. Some carbon dioxide and hydrogen sulfide were also vented, but this did not matter since final analyses were made.

The nitrogen was considered to be removed when the gage showed almost complete recovery of the pressure existing prior to venting the bomb. When the system was considered to be at equilibrium, the Hoke valve at the top of the bomb was opened to an evacuated 125-ml. gas-collecting tube until the gage dropped about 4 psi. The bomb was then removed from the bath, quenched, and opened to obtain a liquid sample.

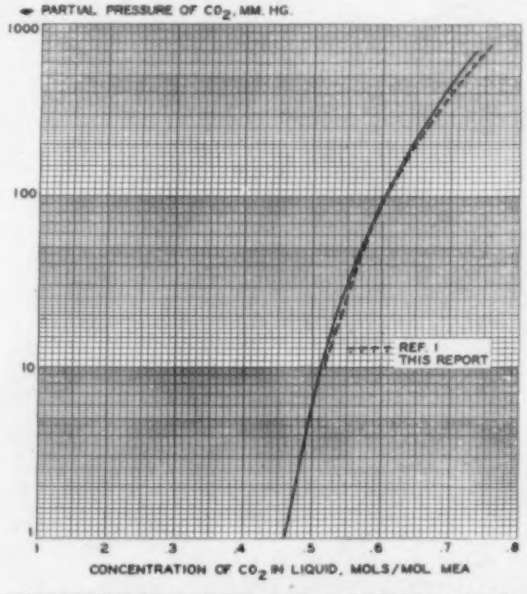
The above method was satisfactory at high total pressures. But it became increasingly inaccurate as the lower pressures were approached because the carbon dioxide and hydrogen sulfide partial pressures were obtained as the small difference between two relatively large values — the total pressure and the partial pressure of water and monoethanolamine. The practical lower limit to the above method was about 150 mm. Hg partial pressure of hydrogen sulfide and carbon dioxide. To get data below this value and down to about 10 mm. Hg partial pressure of hydrogen sulfide and carbon dioxide, an inert gas was introduced into the bomb to raise the total pressure. The bomb was flushed well with argon and after the solution was introduced, was further pressured up with argon.

The bomb and contents were equilibrated thermally for an hour, and then agitated vigorously in the bath to obtain a homogeneous gas phase. The gas and liquid phases were sampled as before.

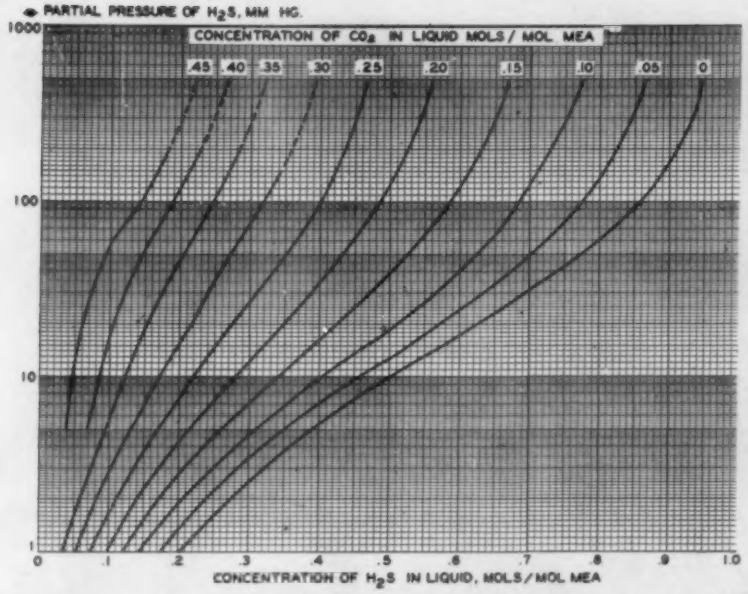
In the time elapse between the sampling of the gas phase (at 100° C.) and the analysis of the gas sample, the pressure in the 125-ml. gas-collecting tube decreased due to condensation of water and cooling. There was the possibility of the pressure decreasing to subatmospheric values and subsequent leakage of atmospheric air into the gas-collecting tube. Had nitrogen been used as the inert gas carrier, there would be no distinguishing between the nitrogen that had been used as inert gas carrier and the nitrogen that leaked into the gas-collecting tube from the air. The use of argon as the inert gas carrier left no question as to the concentration of inert gas used.

Analytical Methods

All liquid samples were analyzed for monoethanolamine, hydrogen sulfide, and carbon dioxide by chemical methods. The monoethanolamine content was determined by potentiometric titration of a 5 cc. sample with stand-



EQUILIBRIUM SOLUBILITY of CO_2 in 2.5 N Monoethanolamine at 25° C. Fig. 3.


PARTIAL PRESSURE OF H_2S, MM HG.
1000
100
10
1
CONCENTRATION OF CO_2 IN LIQUID MOLS / MOL MEA
.45 .40 .35 .30 .25 .20 .15 .10 .05 0
0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0
CONCENTRATION OF H_2S IN LIQUID, MOLS / MOL MEA

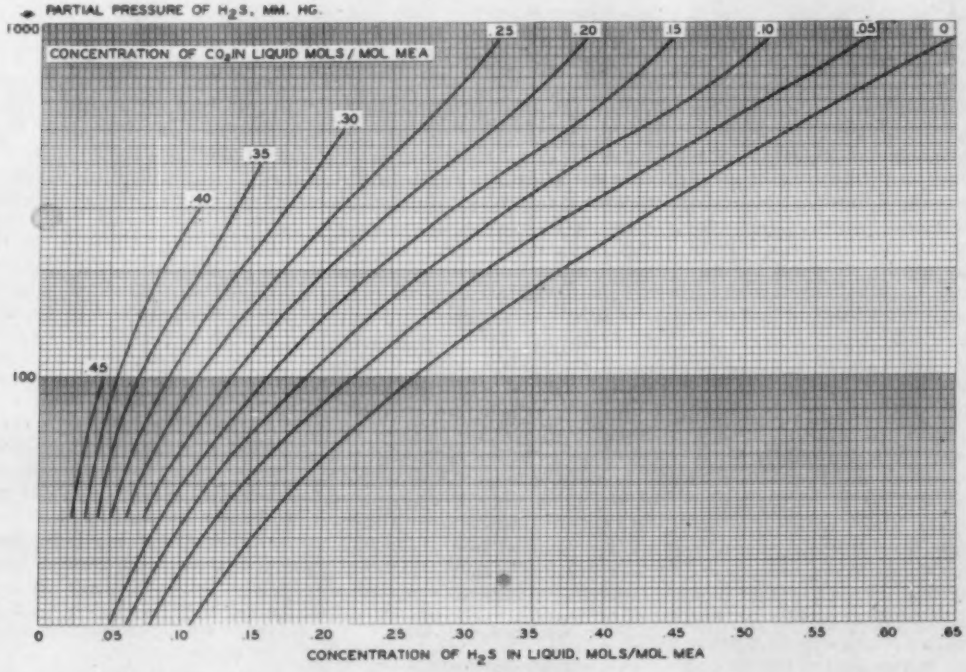
EQUILIBRIUM SOLUBILITY of H_2S in 2.5 N monoethanolamine at 25° C. in the presence of CO_2. Fig. 4.

ard 0.5 N hydrochloric acid. The hydrogen sulfide analysis was effected by the oxidation of the hydrogen sulfide in acid medium with excess standard iodine solution, and titration of the excess iodine solution with standard sodium thiosulfate. The procedure of Reference 9 was followed. The carbon dioxide content of the liquid phase was determined by oxidation of the hydrogen sulfide with potassium dichromate and release of the carbon dioxide by acidification. The carbon dioxide was measured volumetrically. The procedure of Reference 10 was followed.

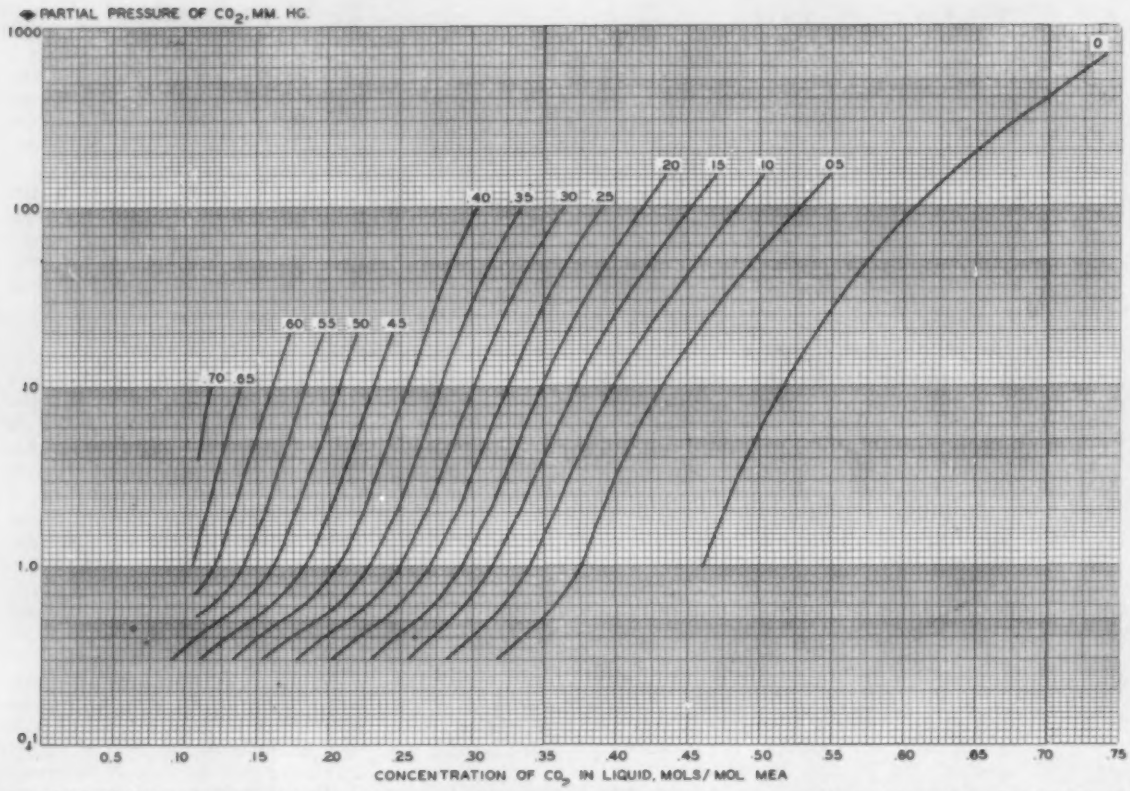
All gas samples were analyzed for hydrogen sulfide, carbon dioxide, nitrogen, and argon by means of Mass Spectrometer Model 21-610 (C.E.C.). The sum of partial pressures of hydrogen sulfide, carbon dioxide and inert gas was determined as the difference between the total observed pressure of the system and the partial pressure of the 2.5 N monoethanolamine solution. At 25° C., a value of 22 mm. Hg was used as the partial pressure of the 2.5 N monoethanolamine solution and at 100° C. this value was determined as 718 mm. Hg by measurement in a Cottrell boiling-point apparatus.

Data Obtained

All the data obtained on the vapor-liquid equilibrium of the system hydrogen sulfide-carbon dioxide-2.5 N aqueous monoethanolamine are presented in two tables. Table 1 gives the results for 25° C. and Table 2 gives the results for 100° C. From these data, two figures were constructed to compare with data already available in the literature on the systems hydrogen sulfide-2.5 N aqueous monoethanolamine, and carbon dioxide-2.5 N aqueous monoethalonamine. Fig. 2, presents the former system and shows the work of this report to be in good agreement with that of Reference 8, but in poorer agreement with the data in Reference 7. Fig. 3 presents the data on the carbon dioxide-2.5 N aqueous monoethanolamine system at 25° C. obtained in this work and those given in Reference 1; agreement is very good.


PARTIAL PRESSURE OF H_2S, MM. HG.
1000
100
CONCENTRATION OF CO_2 IN LIQUID MOLS / MOL MEA
.25 .20 .15 .10 .05 0
.30
.35
.40
.45
0 .05 .10 .15 .20 .25 .30 .35 .40 .45 .50 .55 .60 .65
CONCENTRATION OF H_2S IN LIQUID, MOLS/MOL MEA

EQUILIBRIUM SOLUBILITY of H_2S in 2.5 N mono-ethanolamine at 100° C. in presence of CO_2. Fig. 5.



EQUILIBRIUM SOLUBILITY of CO_2 in 2.5 N monoethanolamine at 25° C. in the presence of H_2S. Concentration of H_2S in liquid, moles/mole MEA. Fig. 6.

Field Processing

Charting the data . . . In order to permit graphic presentation and simpler application of the results given in Tables 1 and 2, a smoothing operation was performed which resulted in the series of curves shown in Figs. 4 to 7. Equilibrium of the hydrogen sulfide-carbon dioxide-2.5 N aqueous monoethanolamine at 25° C. is completely defined by the pair, Figs. 4 and 5, since Fig. 4 shows the hydrogen sulfide equilibria with the liquid concentration of carbon dioxide as a parameter, and Fig. 5 shows the carbon dioxide equilibria with the liquid concentration of hydrogen sulfide as a parameter. The data at 100° C. are presented in the same manner in Figs. 6 and 7.

Although equilibrium of the system H_2S-CO_2-MEA at constant temperatures is completely defined by a pair of figures as just indicated, two more figures are required in the application of these data. They are the H_2S partial pressure vs. H_2S liquid concentration with CO_2 partial pressure as the parameter and the CO_2 partial pressure vs. CO_2 liquid concentration with the H_2S partial pressure as the parameter. These curves are in the process of being prepared.

It should be noted that emphasis was directed at obtaining more complete data on the effect of carbon dioxide concentration on hydrogen sulfide equilibria, rather than the reverse. The curves of Figs. 4 and 6 were the direct aim of the experiments performed. Some additional data would have been desirable in establishing Figs. 5 and 7.

Accurate analysis . . . Accuracy of the above data may be judged from the accuracy inherent in the analysis. Data on liquid concentrations of hydrogen sulfide and monoethanolamine are considered accurate to ±1 per cent of the values given. Carbon dioxide analyses are believed accurate to within ±0.003 moles CO_2/mole MEA. Analyses of the gas phase by mass spectrometry are believed accurate to within ±3 per cent of the values given except at low gas concentrations of carbon dioxide and hydrogen sulfide where the accuracy falls off. Some undetermined error may also be involved in the sampling of the gas phase from the closed static equilibrium system used at 100° C.

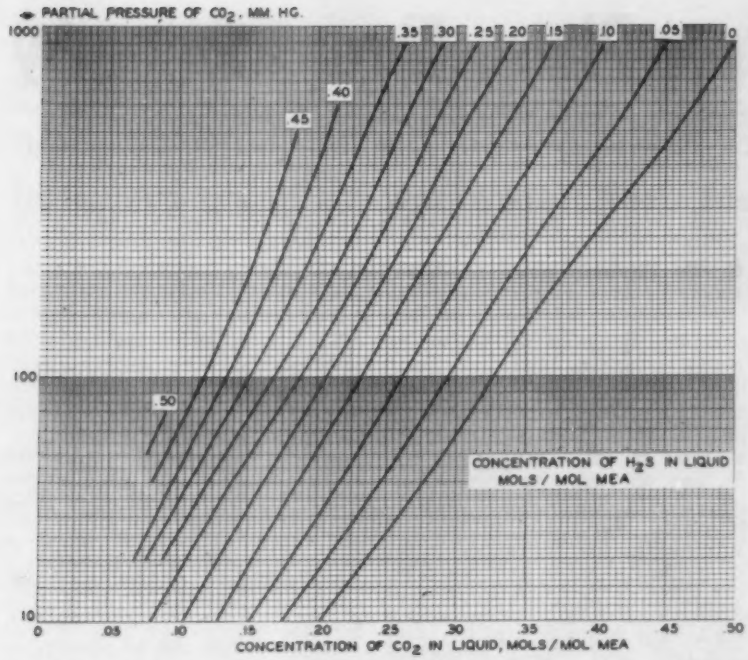
Application of Data

A thorough discussion of the application of these data to design and operating problems is beyond the scope of this article. This discussion is based on a small number of spot checks. Time available did not permit extension studies of varying conditions.

In general, one would work with these data in much the same manner as with equilibrium data on the simple systems CO_2-MEA and H_2S-MEA. The combined system under discussion here is somewhat more complex inasmuch as each acid gas has a depressing effect on the solubility of the other. Furthermore, the ratio of H_2S/CO_2 is difficult to predict at any level in the tower. A combination of the treatment from the text of Sherwood and Pigford with some cut-and-try appears to be an approach to use.

Simplifying assumptions . . . Certain simplifying assumptions might be made to facilitate the solution. Constant temperature, constant pressure, complete removal of acid gas from the gas leaving the contactor, complete regeneration of the lean amine solution to the contactor, and a fixed ratio for H_2S/CO_2 in the liquid and gas phases at all points in the contactor are the assumptions which could be made.

Equilibrium curve . . . These assump-



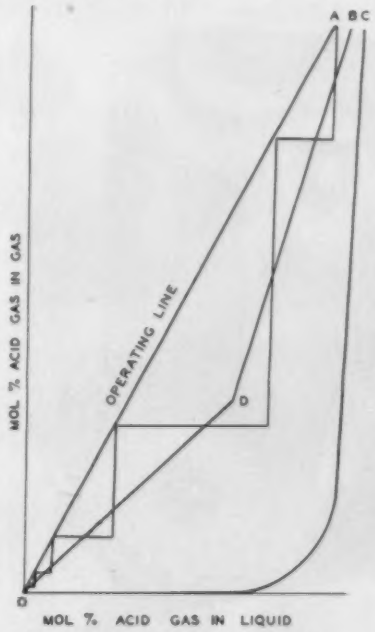
EQUILIBRIUM SOLUBILITY of CO_2 in 2.5 N monoethanolamine at 100° C. in the presence of H_2S. Fig. 7.

tions will enable one to use the data presented here to construct for a given set of conditions a preliminary vapor-liquid equilibrium curve for the total acid gas in the vapor and the total acid gas in the liquid. This is demonstrated in Fig. 8 by OC. The two terminal points on such a curve will be accurate. Points along the middle of the curve will have some degree of inaccuracy. This is true because the assumption of constancy in the ratio of H_2S/CO_2 is not valid. Some correction in the curve will need to be made in most cases before proceeding with a solution.

A third point which will be accurate and located in the middle of the curve can now be fixed so that OC can be redrawn to conform to it and to the general shape of the first curve.

This third point is one which describes the equilibrium on the last theoretical plate in the tower. At this point, the solution leaving the plate (and leaving the tower) will be in equilibrium with the gas leaving the last theoretical plate. Further, the ratio for H_2S/CO_2 in the solution leaving the last theoretical plate will be the same as that ratio in the raw gas to the plate. By material balance, all acid gas entering the tower via the raw-gas feed leaves the tower via the rich amine solution, and the ratio of H_2S/CO_2 must be the same in each case.

Operating line . . . Point A on the operating line OA will represent the condition of the rich solution leaving the tower. Knowing the acid-gas content of this liquid, the composition of the vapor leaving the last theoretical plate can be gotten from the data given here. This will give the third accurate point. The curve OC as corrected by this point can be considered



APPLICATION OF DATA, showing preliminary equilibrium curve OC and operating line OA. Fig. 8.

reasonably accurate. Further checks on its accuracy, however, are possible and can be done if desired.

The operating line OA is shown with a slope which corresponds to a gas volume-liquid volume ratio considered to be optimum. As shown, the slope of the operating line might represent a solution rate such that the rich solution leaving the contactor will have an acid-gas content of 30 cu. ft. per cubic foot of solution. To decrease the slope of the operating line OA, will increase the acid-gas content of the rich solution beyond 30 cu. ft. per cubic foot of solution, a condition which is considered hazardous from a corrosion standpoint.

To increase the slope of the line by increasing the solution circulating rate for a given gas flow will result in reduction of the acid-gas content of the rich solution below 30 cu. ft. per cubic foot of solution. While there is no particular hazard in going in this direction, the steam requirements in the stripper will increase almost proportionally to the increase in solution circulating rate.

Solving for the number of theoretical plates or theoretical transfer units can be done by a number of methods. In Fig. 8 a graphic solution for the number of theoretical transfer units according to the method of T. C. Baker[12] is shown. Other methods could be used. Plate by plate calculations might also be used.

Given the gas flow rate and the liquid circulating rate, calculation of the tower diameter can be done by conventional means depending on the type of plates, trays, or packing used.

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A Look at Vapor-Phase Chromatography

It has excited the boys in the lab—but what about actual plant use? Here's how it's being evaluated

by C. C. Helms and S. Norem

THE past year has been witness to the rapid growth of vapor phase chromatography as a major tool of the laboratory analyst. Every day the analyst is finding new aplications for this newcomer. Therefore, it is not surprising that estimates place the number of commercial **laboratory** chromatography instruments now in use at about 1,000.

● In view of the extreme versatility and fundamental simplicity of the method, it is only natural that serious consideration be given to extending it to the field of **continuous analysis** and **process control** instrumentation.

● To this end, a program has been undertaken at Perkin-Elmer with the principal goal being an evaluation of the method itself. The design of an elaborate, wide-range instrument seemed premature until such questions as, "How long will a column last?" and "How can column contamination be prevented?" could be answered by actual experience. The decision was made to produce an interim instrument in limited quantity. It was felt that several of these instruments placed at various actual plant installations in the petroleum and chemical industries would provide a valuable base of experience for the design of a more sophisticated production model.

Authors are with Perkin-Elmer Corp., Norwalk, Conn. Paper presented at conference on analytical chemistry and applied spectroscopy held at Pittsburgh, Pa., March 7, 1957.

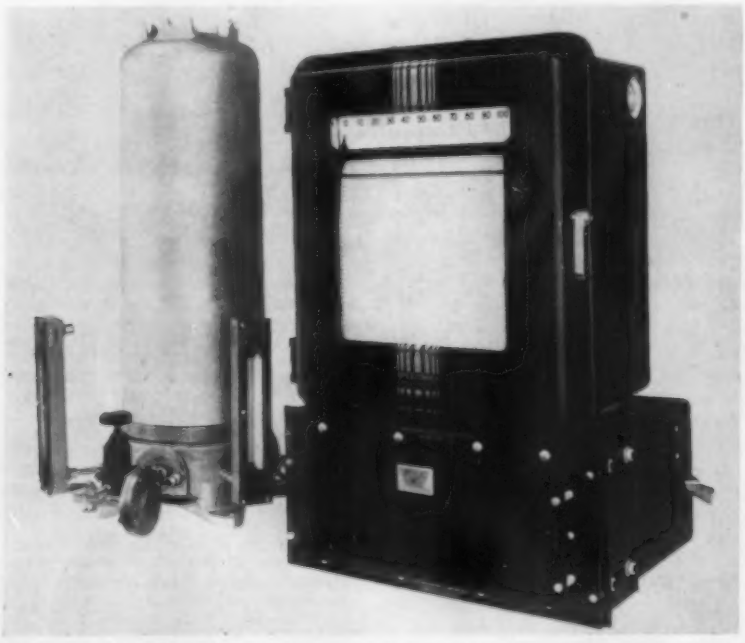
Performance Specifications

A reasonable set of performance requirements for such an interim instrument was drawn up. These called for an instrument capable of handling a group of analyses limited in range but large in number. An operating temperature of 50°C. was selected as one which avoids severe thermostating difficulties and component problems. Only samples which are entirely in the vapor phase at this temperature were considered for these interim instruments.

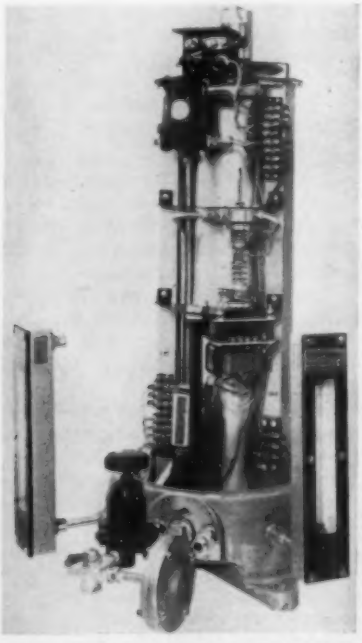
Specifications . . . These stated that quantitative analysis of up to five components shall be possible, although other components may be present provided they do not interfere with components of interest. The minimum dynamic range or ratio of largest to smallest component concentration shall be 100 to 1. The ultimate range will, of course, be dependent upon the problem and the elution order of components, since peak height measurement was specified.

Reproducibility of ±½ per cent of range and zero stability of ±½

Field Processing



EXPERIMENTAL process vapor fractometer. This consists of three units: an analyzer, a programer, and a recorder. The various parts are shown in detailed views in the other photographs. Fig. 1.



ANALYZER is an explosionproof laboratory vapor fractometer with motor-driven gas-sampling valve. Fig. 2.

Ten prototype vapor fractometers developed by one company are now in the field working on actual plant problems. The experience so obtained will go into production of a wide range model for plant use.

per cent of range in an 8-hour period must be met.

Record . . . Data shall be presented in the form of a bar graph. This is simply a convenient display of peak heights, with a recorder chart advanced a uniform distance between successive component peaks. Direct calibration by means of a sample of known composition, together with a separate range control for each component, shall allow percentage concentrations to be read directly from the recorder chart.

The carrier gas used shall be helium. A size 1A bottle must be sufficient for at least 1 month of continuous operation. A clean, dry sample, free from known column contaminants, shall be introduced into the analyzer at a rate of not more than a few liters per hour, and not more than a few cc. of calibrating mixture shall be required every 8 hours.

Ambient temperature . . . The instrument shall operate over an ambient temperature range of —10° to 115° F., and up to 95 per cent relative humidity. The analyzer must meet Class I Group D Division I requirements for hazardous locations. The programer unit and recorder must be purgeable.

The instrument shall not require attention more than once per 8-hour shift. This attention may include manual base-line correction and recalibration of peak heights by introduction of a known sample.

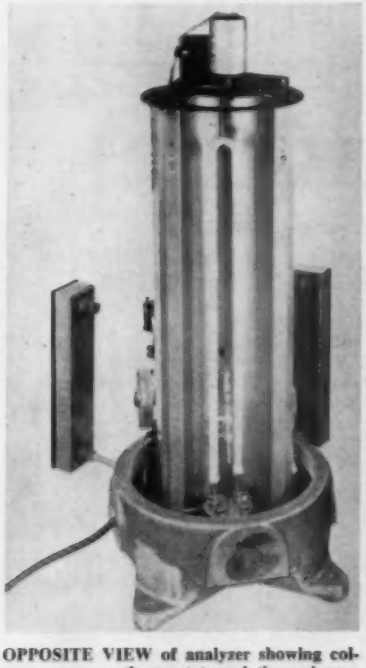
The Interim Instrument

Fig. 1 shows the Model 178 industrial vapor fractometer which was designed to meet these requirements. It consists of three units: an analyzer, a programer, and a recorder. The programer unit can be seen to have a front-cover attachment to prevent unauthorized personnel from tampering with the controls which are brought out on the front panel. The sample filter, selector valve, and regulator are attached to the base of the analyzer in addition to the two flow indicators.

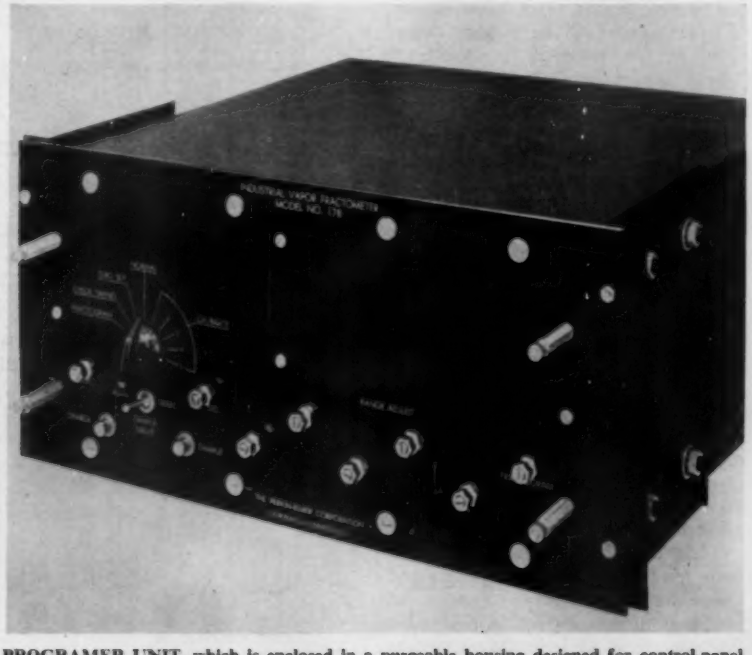
Fig. 2 shows that the analyzer is essentially an explosionproof laboratory vapor fractometer, equipped with a motor-driven gas-sampling valve. The chromatographic column or columns, thermistor thermal conductivity detector, and secondary carrier pressure regulator are enclosed together with the sampling valve in a circulating air bath thermostated at 50°C. Visible in side view are: the secondary pressure regulator at the extreme top left, the sample valve and motor in the right center section, and thermostat circuitry at the lower left, behind the motor mounting post. Rotameters, mounted externally, indicate carrier gas and sample flow rates. A manually operated three-way valve is provided so that the instrument may be switched from sample stream to calibrating mixture.

Fig. 3 shows the opposite view of the analyzer with one-half of the chimney section removed, thus showing the column, mercury thermostat, and thermal conductivity detector. The detector block has two extra column connections. Columns may be placed in series by making use of a short U-connection which is built into the detector block.

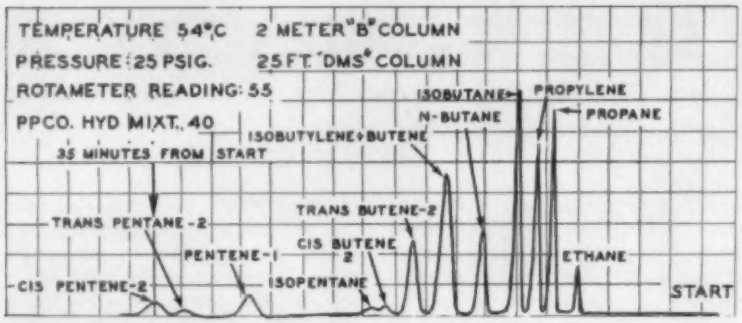
Fig. 4 shows the programer unit which is enclosed in a purgeable housing designed for control panel mounting. It contains a cam recycling timer which performs four basic functions: (1) actuates the motor-driven gas-sampling valve; (2) selects the appropriate recorder range for



OPPOSITE VIEW of analyzer showing column, mercury thermostat, and thermal conductivity detector. Fig. 3.



PROGRAMER UNIT, which is enclosed in a purgeable housing designed for control-panel mounting. The front-cover attachment is shown in Fig. 1, but in this view it has been removed. Fig. 4.



SEPARATION obtained for a representative hydrocarbon sample. A series combination of 25 per cent dimethylsulfolane on firebrick and 2 m. of Perkin-Elmer B column permits adequate separation with relatively short total column length. Fig. 5.

each of up to five components of interest; (3) advances the recorder chart between bands, resulting in a bar-graph data presentation; and (4) provides for base-line display in the bar-graph mode of operation.

In addition, the programer contains the precision potentiometers which are the range controls; the thermal conductivity bridge controls and power supply; and a calibrating circuit for precision peak-height adjustment. A mode selector switch and manual controls for the gas valve are also present.

The recorder is a Leeds & Northrup Speedomax G 0-5-mv. instrument with a 1-second full-scale response, modified for bar-graph operation by insertion of a one-revolution clutch in the chart drive mechanism.

Operation of Instrument

The system has three basic modes of operation which have been designated by the terms of "fractogram," "check timing" and "normal".

Chromatographs . . . Operation in the **fractogram mode** produces a series of regular fractograms or chromatographs, with all component peaks appearing at the same sensitivity. The only function of the timer in this mode is to actuate the gas-sampling valve. With the manual sampling valve controls used in place of the timer, the instrument may be used in the same manner as a conventional laboratory vapor fractometer. This mode is used principally in establishing operating conditions to give desired peak separation, length of run, sample volume, and so forth. It is also useful as a means of checking for possible interference from impurities in the sample.

The **check timing mode** is essentially a fractogram with programed attenuation of bands. Its principal use, as the name implies, is to observe the setting of the timer-gate widths and occurrence times with the recorder chart running continuously. It has been found to be quite convenient in that it eliminates the need for extreme precision in setting the timer initially, as minor errors can be seen and corrected on the basis of a "check timing" run.

The **normal mode** is the bar-graph presentation. It differs from the check timing mode only in that the recorder chart is advanced in uniform steps between the component peaks.

Settings . . . The procedure used in setting up the instrument for a problem is straightforward. A few fractograms of the sample are run, and operating parameters adjusted to give desired separation and length of run. The length determines the timer-cam speed, which is adjusted by means of a set of easily interchangeable gear racks. The various switching functions are then marked directly on the final fractogram, and their widths and occurrence times measured in inches. A sensitizing data sheet is used to convert this information to timer settings.

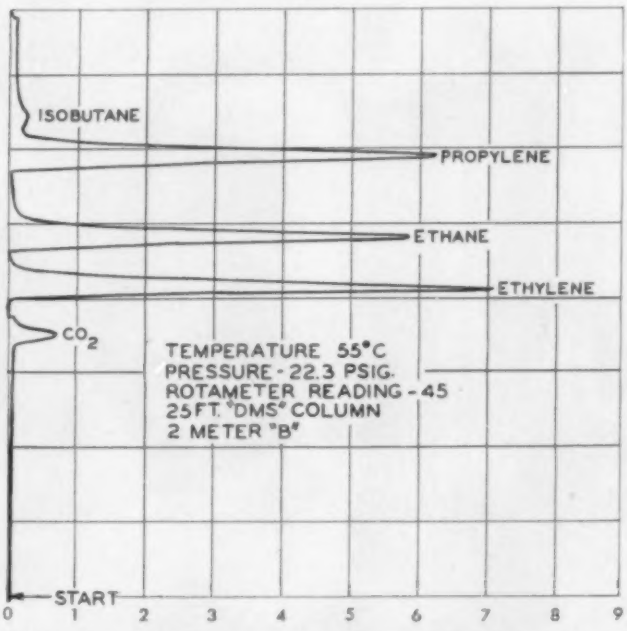
Check run . . . When the timer has been adjusted to these settings, a check-timing record is run and necessary corrections made. Recorder range for each component of interest is then set by using a calibrating mixture of known composition. Once all peaks are on scale, the calibrating circuit may be used to adjust the range as desired.

Normal mode . . . The instrument is now ready to run in the normal or bar-graph mode. Once per 8-hour shift, base line is checked and corrected if necessary, and the calibrating mixture introduced and range settings checked. Range recalibration will not be required every shift but initially it should be checked. After a few days' running time, it may be possible to make the check on a weekly basis.

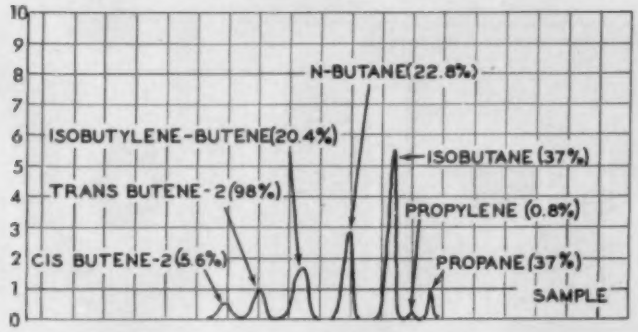
Field Processing

Process Fractometer-Separating Ability

In the final analysis the ultimate usefulness of a process or laboratory fractometer depends upon the ability of column to perform an adequate separation when operated in the en-



THIS SHOWS the lighter hydrocarbon separation possible using the same column combination. This is useful down to and including CO_2, but silica gel or molecular sieve column would be required for analysis of hydrogen or nitrogen. Fig. 6.

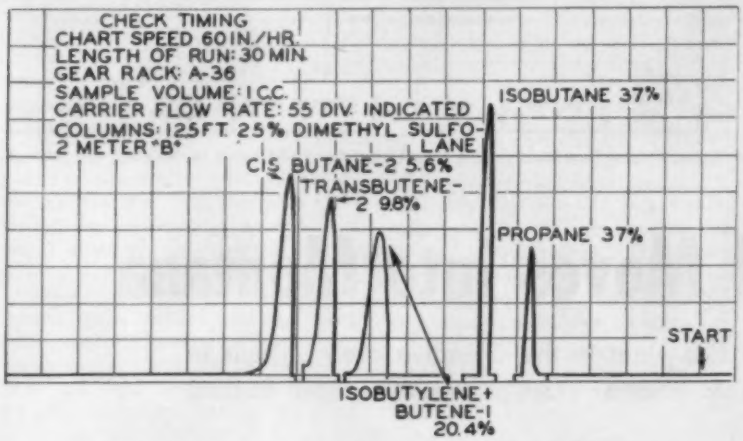


PERFORMANCE on C_3-C_4 components is shown in chromatograph. Chart speed 60 in. per hour, length of run 30 minutes, gear rack A-36, sample volume 1 cc., carrier flow rate 55 divisions indicated, columns: 12.5, 25 per cent dimethylsulfolane 2 m. "B." Fig. 7.

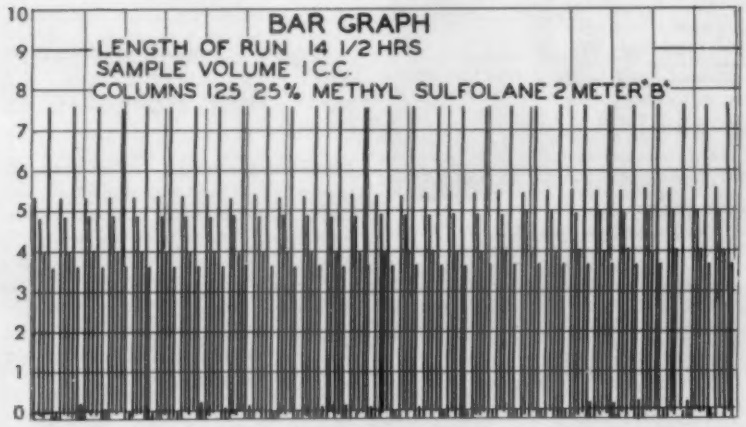
vironment of the specific instrument. A process instrument makes further demands upon the column in that a great number of repetitive separations must be made stably and accurately at an elevated temperature.

We thus realized that a majority of the columns used in the laboratory field would not meet the requirements of the interim instrument. A column which will perform 200 separations is considered useful as a laboratory column. On a 20-minute cycle, 72 separations are performed a day and hence the life would be less than 3 days.

After making extensive tests comparing columns for separating ability, length of run, and stability, a series combination of 25 per cent dimethylsulfolane on firebrick and 2 m. of Perkin-Elmer B column were used in the interim instruments.



CHECK TIMING mode of operation is illustrated here. Fig. 8.



REPRESENTATIVE SAMPLE of run. Range and zero stability of 0.5 per cent were achieved for an 8-hour period. Succeeding 8-hour runs continued to be equally acceptable. Fig. 9.

Field Processing

Separation . . . Fig. 5 shows the separation obtained for a representative hydrocarbon sample. The series combination permits adequate separations with a relatively short total column length. This is accomplished by taking advantage of the fact that each column complements the other by making the separation that the other fails to accomplish. Therefore, it is possible to select suitable lengths to resolve the components of interest to the greatest degree.

Fig. 6 shows the lighter hydrocarbon separation possible using the same column combination. They are quite useful down to and including CO_2, but a silica gel or a molecular sieve column would have to be used for the analysis for hydrogen or nitrogen.

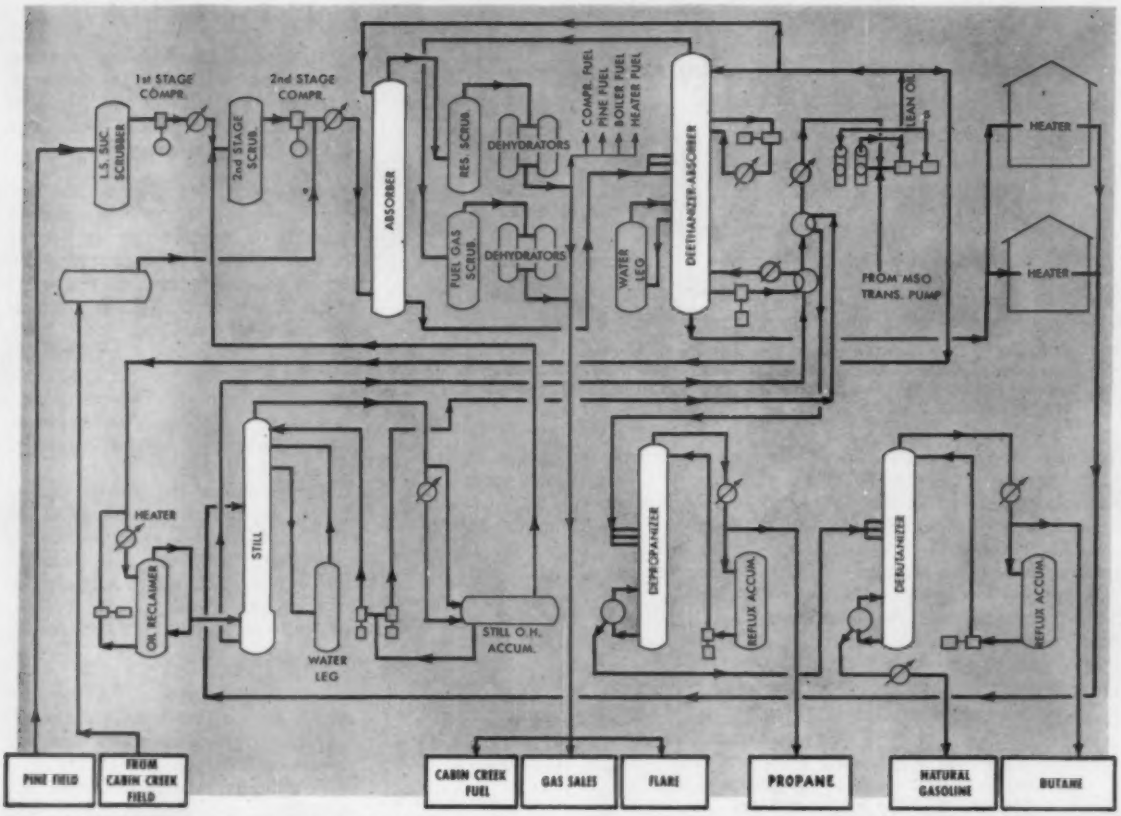
Accelerated life tests . . . These have been performed on these columns by operating them at elevated temperatures with nitrogen carrier gas flowing constantly. The results show that pneumatic resistance decreases with time but that the elution times are constant if the flow is held constant. This is very important in that it shows that a flow regulator should be used in preference to a pressure regulator in the carrier line.

Evaluation Problems

An evaluation problem performed upon the Model 178 interim fractometer is illustrated by Fig. 7. With C_3 to C_4 components present, five were selected and the programer was set up and then checked with the check timing mode of operation illustrated by Fig. 8. The components of interest are within the gates and have been calibrated using the calibration mode of operation. The negative pulses at the bottom indicate the position of the gates actuating chart advancement for bar-graph operation. The instrument was allowed to run on this program for 1 week. A representative sample of this run is shown in Fig. 9. The range and zero stability of $\pm\frac{1}{2}$ per cent were achieved for an 8-hour period. Succeeding 8-hour runs continued to be equally acceptable.

Field Trials

To date 7 of the 10 instruments authorized for this program have been set up on customers' problems, tested, and shipped. The remaining three will be in the field shortly. **End.**



PROCESS FLOW SHEET for Plant No. 11 of Texas Natural Gasoline Corp. in Pine Unit-Cabin Creek fields of Montana has throughput capacity of 5,300 M.c.f.d.

Texas Natural Moves Into Montana

New 5,300-M.c.f.d. plant in the Glendive area is built in record time. Cold-weather startup presents special hazard

by John Sutherland

THE eleventh plant to be owned or operated by Texas Natural Gasoline Corp. went on stream in the Pine Unit-Cabin Creek fields, Wibaux and Fallon counties, Montana, on December 17, 1956. Using all possible equipment from a previous joint-ownership project, the former plant was dismantled, the equipment moved nearly 1,500 miles by truck, and the new plant was erected and winterized in less than 6 months. Virtually all engineering, design, and construction of the new plant was done by Texas Natural personnel.

General Features

The design propane recovery of the plant is 80 per cent with a throughput of 5,300 M.c.f.d. of field gas. The product yield under design conditions is as follows:

Commercial propane, 21,000 gal. per day.

Commercial butane, 14,000 gal. per day.

14-lb. natural gasoline, 7,000 gal. per day.

Due to low winter gas-oil ratios and lean gas, the plant has yielded the following product volumes during the first months of operation:

Commercial propane, 12,000 gal. per day.

Commercial butane, 6,500 gal. per day.

14-lb. natural gasoline, 3,500 gal. per day.

Field Processing

Minimum personnel . . . The plant plot plan was laid out to minimize operator work. Controls were centralized, and an elaborate alarm and shutdown system was installed to allow the operator to identify at a glance any cause of an upset. As soon as supervisory personnel housing is available at the site, it is planned to operate the plant with one man on shift.

Process cycles . . . The process is a conventional oil absorption-rich oil deethanizer cycle with totally con-

ENTIRE PROCESS AREA of the new Glendive plant is housed in a single building.

densed still overhead and cascade fractionation. (See flow diagram). Steam is the prime source of heat supplemented with a direct-fired still preheater. The steam balance is so made that exhaust steam from the process pumps is used for oil stripping, fractionator reboilers, and general utility service.

Winterizing . . . Nearly all equipment is housed for operator accessibility. A bare minimum of steam tracing was found necessary after housing. The entire process area, including all vessels except the absorber, is housed in a single building. Other buildings include the compressor building, suction scrubber house, cooling tower pump house, boiler house, loading pump house, and fire pump-emergency generator house. Extensive gas dehydration has been installed to prevent freezeup of fuel gas lines in the plant or in the field, dehydrators being installed on both the absorber residue and the deethanizer overhead streams. Instrument air is also dehydrated. All buildings are heated by fin-fan steam radiators except the boiler house. The plot plan was laid out in an open square with the cooling tower and boiler house serving as a windbreak against the prevailing north and west winds.

A specially designed cold-weather cooling tower was purchased for the location. It consists of a single cross-flow induced-draft tower with the entire north, east, and west walls enclosed. Reversible, two-speed fans permit rapid deicing and temperature control over a broad range of atmospheric conditions.

All water and wet-gas piping and concrete footings are set below a 6 ft. frost line. Virtually all meters, controls, and instruments are located inside the buildings.

Booster stations . . . A fully automatic booster compressor station picks up the gas from Cabin Creek field and delivers gas and condensate at absorber pressure through an 8-mile delivery line. Since design conditions permitted the use of a tapered 4 and 6-in. delivery line, the smaller pipe was laid in uphill segments to increase the velocity, and lift the condensate over the hills with minimum surging. Air-fin cooling has been provided for both interstage gas and jacket water. Automatic louvers are used in conjunction with a hydraulic fan drive to control temperatures. Glycol antifreeze is used as an added precaution to prevent jacket-water freezeup.

THE AUTHOR

John Sutherland is chief engineer in charge of engineering and operations for Texas Natural Gasoline Corp.'s 11 natural-gasoline plants. He joined Texas Natural in June 1955. He was born in Kansas City, Mo., and was graduated from University of Missouri in 1948 with a B.S. in chemical engineering.

Prior to joining Texas Natural, Sutherland was associated with Stanolind Oil & Gas Co. from 1948 to 1951 as junior engineer in New York City on a synthol project, in Tulsa in the process design department, and in Wyoming as a chemist at the Salt Creek and Elk Basin gasoline plants. He joined Sunray Oil Corp. in 1951 as a senior engineer at the Benton unit cycling plant, later coming to Tulsa as an engineer in the technical service department and gas-gasoline division of the production department.

Field Processing

Gathering systems . . . The unique elongated character of Pine and Cabin Creek fields due to the narrow oil-field structure makes for an extremely simple gathering system with all delivery points within a very short distance of a single trunk line. All gathering lines are buried to a depth of 6 ft. to prevent freezing. Lines are carefully graded to drain into buried drips at low points. Although average line grades in excess of 200 ft. per mile were encountered in this rugged terrain, the number of drips was minimized by contouring the line around the highest points, and intermediate knolls.

Water supply . . . No usable water is available in the oil field, but a prolific water-bearing sand outcrops on the edge of the structure. Water is quite soft but strongly alkaline. Chemical decarbonation is used to remove harmful carbonates from the boiler feed water. The cooling tower is acid treated and a concrete cooling tower coil shed was built to minimize loss in structural strength due to delignification.

Plant Startup

The plant startup was especially hazardous due to the subzero temperatures. It was necessary to have all parts of the system free of water after testing and before actual startup. Once the boiler plant was started, it was absolutely necessary to keep steam on the plant at all times to prevent freezeup of the steam condensate system. A 2-in. residue return line to the booster station was "packed" with gas to provide reserve fuel in the event of engine failure and, although the engines were lost several times during the initial operation, steam supply was maintained. All steam tracing was plastically bonded to the pipe and other equipment to give maximum efficiency and to prevent insulation from getting between the tracing and the equipment being heated.

Product Treating

Due to the fact that all product will be marketed in the local area, special provisions have been made to insure the manufacture of dry product. Not only have the customary propane driers been installed, but as added insurance against freezeup of L.P.G. mixes butane driers are also provided. The entire product stream from the plant is caustic washed to remove corrosive sulfur compounds. The gasoline, although virtually doctor sweet, is copper chloride treated. **End.**

Journal Field Processing Survey Shows . . .

Natural Gasoline-L.P.G. Output Is Up 6.6 Per Cent in U.S.

TOTAL output of U. S. natural-gasoline plants reached 31,237,135 gal. per day as of January 1, 1957, up 6.6 per cent over the previous year.

Cycling-plant output decreased only a fraction from the previous year to average 6,521,504 gal. per day.

Canadian output is confined to the Province of Alberta where eight plants averaged 266,340 gal. per day of natural gasoline and L.P.G. Canada's ninth plant is under construction at Taylor Flats, B. C., and should be on stream late this year.

Journal Survey of U.S. Field Processing Plants as of January '57

State—	No. plants	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Comb. nat. gaso. and L.P.G. prod. stream (gal./day)
Arkansas	8	175	75	86,105	112,017	37,100
California	72	1,768	1,077	1,194,388	889,718	1,195,261
Colorado	7	114	104	84,287	108,894	224,823
Illinois	6	533	494	81,700	760,000	60
Kansas	16	1,867	1,033	312,243	337,759	100,916
Kentucky	5	1,131	35	90,000	430,000	9,060
Louisiana	33	1,825	814	444,614	489,046	454,419
Michigan	1	7	3	.....	.....	6,000
Mississippi	1	18	18	6,800	6,700	.....
Montana	2	60	51	10,000	13,000	50,000
Nebraska	3	33	16	15,667	34,112	46,000
New Mexico	20	1,537	377	744,853	998,535	507,000
North Dakota	1	65	39	22,000	116,000	.....
Ohio	2	15	.....	.....	.....	2,500
Oklahoma	57	1,423	1,125	823,303	1,210,933	754,161
Pennsylvania	5	89	36	.....	.....	9,405
Texas	201	11,338	6,003	4,532,965	6,765,856	6,553,067
Utah	1	22	10	.....	.....	800
West Virginia	36	578	139	112,685	154,058	43,912
Wyoming	10	276	213	92,335	134,088	27,990
Total U. S.	487	22,874	11,662	8,653,945	12,560,716	10,022,474

Natural-Gasoline-Plant Survey

What the symbols mean . . .

*Gas injection conducted. †Plant figures estimated. ‡Not reported. ¶Figures represent capacity, not production. §Plant primarily for removing liquids from gas to prevent them dropping out in pipeline; not for commercial production of gasoline.

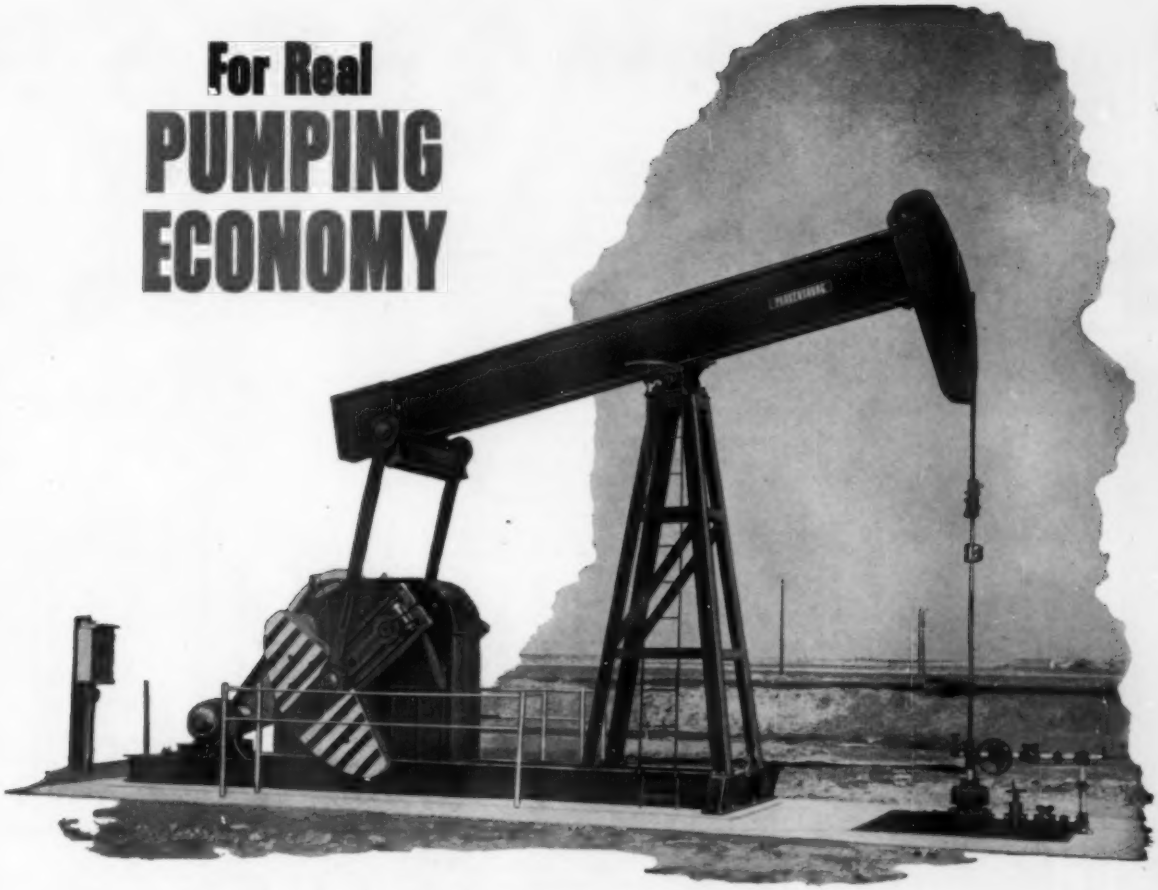
Arkansas

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Arkansas Louisiana Gas Co.:					
Dorcheat-Macedonia, Columbia (Magnolia)	100	51	23,600	53,400	.....
Arkla Oil Co.:					
Loe, Miller (Rodessa)*†	22	.....	20,000	4,000	.....
Atlanta Gas Co.:					
Atlanta, Columbia (Magnolia)†	4	.....	5,000	6,000	.....
Lion Oil Co. Division of Monsanto Chemical Co.:					
Shuler, Union (El Dorado)*	30	18	.....	12,500	24,000
Magnolia Petroleum Co.:					
Kenova, Union (Smackover)	1.7	1.5	5,805	1,117	.....
Querbes, J. R., Oil Co. (vacuum plant):					
South, Union (El Dorado)	1.5	1.5	.....	.....	5,500
Shell Oil Co.:					
Magnolia, Columbia (Magnolia)	12	(‡)	31,700 (26 lb. R.v.p.)	23,600	.....
Sunray Mid-Continent Oil Co.:					
Midway, Lafayette (Lewisville)	3.5	2.5	.....	11,400	7,600 (Solvents)
Total	174.7	74.5	86,105	112,017	37,100

California

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Bankline Oil Co.:					
Santa Fe Springs, Los Angeles (Santa Fe Springs)	5	2	15,000	700	.....
Midway-Sunset, Kern (Maricopa)	10	7	8,000	600	.....
Belridge Oil Co.:					
Belridge, Kern (McKittrick)*	80	(‡)	37,800	20,000	.....
Brea Canyon Oil Co.:					
Brea†	.....	.....	.....	.....	15,000
Coline Gasoline Corp.:					
Rincon-Padre, Ventura (Ventura)	20	14	15,000	33,000	.....
Continental Oil Co.:					
San Miguelito, Ventura (Ventura)	30	29.2	.....	16,376 (Propane)	44,261
Cowan Oil & Refining Co.:					
Rosecrans†	.....	.....	.....	.....	10,000

For Real PUMPING ECONOMY



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PESA

NATURAL-GASOLINE-PLANT SURVEY (California continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
General Petroleum Corp.:					
Wilmington, Los Angeles (Wilmington)	50	38.5	.....	.....	185,000
Santa Fe Springs, Los Angeles (Santa Fe Springs)	24	23.5	.....	.....	61,500
Ventura, Ventura (Ventura)	15	6.5	.....	.....	14,000
Helm, Fresno (Burrel)	25	12	12,500	14,000	.....
Honolulu Oil Corp.:					
Buena Vista Hills, Kern (Buena Vista)	12.5	11	15,000	5,500	.....
Cymric, Kern	30	18	21,200	21,200	.....
Inglewood Gasoline Co.:					
Potrero, Los Angeles (Inglewood)	5	5	.....	.....	5,000
Lomita Gasoline Co.:					
Signal Hill, Los Angeles (Long Beach)	45	35	100,000	10,000	.....
Magruder, P. S., Oper., Western-Huffman Gasoline Plants:					
Western, Kings (Avenal)	65	47	37,788	25,092	.....
Monterey Oil Co.:					
Huntington Beach, Orange (Huntington Beach)	12	3	23,000	3,000	.....
Rice Ranch Oil Co.:					
Orcutt, Santa Barbara (Santa Maria)	1	0.5	.....	.....	1,600
Richfield Oil Corp.:					
North Coles Levee, Kern (Tupman)*	160	128	113,000	51,000	.....
South Cuyama, Santa Barbara (Cuyama)*	80	72	73,000	38,000	.....
Russell Ranch, San Luis Obispo (Cuyama)*	18	18	30,000	14,000	.....
East Los Angeles, Los Angeles (Los Angeles)	3	3	.....	.....	3,000
Shell Oil Co.:					
Brea, Orange (Brea)	17	(‡)	.....	.....	56,000 (75 lb. R.v.p.)
Capitan, Santa Barbara (Santa Barbara)	0.6	(‡)	.....	250	1,200 (42 lb. R.v.p.)
Long Beach, Los Angeles (Long Beach)	5.1	(‡)	.....	.....	36,200 (56 lb. R.v.p.)
Santa Maria, Santa Barbara (Santa Maria)	0.6	(‡)	.....	.....	1,600 (45 lb. R.v.p.)
Ten Section, Kern (Bakersfield)	33	(‡)	22,800 (22 lb. R.v.p.)	55,500	.....
Ventura, Ventura (Ventura)	106	(‡)	.....	59,500	247,000 (55 lb. R.v.p.)
Signal Oil & Gas Co.:					
Signal Hill, Los Angeles (Long Beach)	40	22	46,000	13,000	.....
Ellwood, Santa Barbara (Santa Barbara)	15	3	4,000	2,000	.....
Huntington Beach, Orange (Huntington Beach)	50	40	109,000	31,000	.....
Standard Oil Co. of California, Western Operations, Inc.:					
Huntington Beach, Orange (Huntington Beach)	15	9	36,000	7,600	.....
Inglewood, Los Angeles (Inglewood)	15	9	.....	.....	21,200
Murphy Coyote, Orange (La Habra)*	50	37	49,000	13,000	.....
Santa Fe Springs, Los Angeles (Santa Fe Springs)	5	2	.....	.....	15,500
Seal Beach, Los Angeles (Seal Beach)	22	21	.....	.....	34,500
Torrance, Los Angeles (Torrance)	6	5	.....	.....	9,000
Midway, 1-C Kern (Taft)*	37	36	50,000	6,900	.....
Midway, 7-D, Kern (Taft)	8	8	.....	.....	16,000
Midway, 29-C, Kern (Taft)	7	7	.....	.....	9,500
Greeley, Kern (Bakersfield)	25	24	21,000	30,600	.....
Lost Hills, Kern (Bakersfield)	3.5	3	.....	.....	3,200
Mountain View, Kern, Bakersfield)	17	16	.....	.....	18,000
Kettleman North Dome, 11P, Kings (Avenal)*	40	25	.....	.....	36,000
Kettleman North Dome, 3P, Kings (Avenal)*	60	38	17,000	67,500	.....
Kettleman North Dome, 33J, Fresno (Avenal)*	40	25	.....	.....	32,000
Northeast Coalinga, Fresno (Coalinga)	40	8	.....	.....	5,000
Colonia Vapor Plant, Ventura (Oxnard)	1	1	.....	.....	1,000
Standard Oil Co. of California, Oper., Naval Petroleum Reserve No. 1:					
Elk Hills, Kern (Tupman)*	4	2	.....	.....	2,500
Sunray Mid-Continent Oil Co.:					
Newhall-Potrero, Los Angeles (Los Angeles)	(‡)	46.6	23,300	33,400	.....
Superior Oil Co.:					
Rio Bravo, Kern (Shafter)*	30	(‡)	19,000	48,000	.....
Texas Co., The:					
Honor Rancho, Los Angeles (Castaic)*	18	(‡)	¶11,000	¶14,000	.....
Santa Fe Springs, Los Angeles (Santa Fe Springs)	12	(‡)	¶50,000	¶3,000	.....
Signal Hill, Los Angeles (Signal Hill)	30	(‡)	¶65,000	¶9,000	.....
Shiells Canyon, Ventura (Fillmore)	24	(‡)	¶24,000	¶30,000	.....
Tidewater Oil Co. (three plants): Ventura, Ventura (Ventura)*	83	69	.....	93,000	59,000
Union Oil Co. of California: Stearns, Orange (Brea)	24	19.7	50,000	15,000	.....

82 PLANTS

1945

Mid-Co. — Malakoff, Texas

1946

T G & T — Jefferson, Texas
Southern Minerals — Agua Dulce, Texas
Hunter & Hunter — Novice, Texas

1947

Warren — Fairbanks, Texas
Pan American — Kountze, Texas
T G & T — San Salvador, Texas
Gray Wolfe — Pinehurst, Texas

1948

Warren — Fairbanks, Texas
Warren — Mobile, Alabama
Lion — Shuler, Arkansas
Gulf — Kiefer, Oklahoma
Wehlu — Edmond, Oklahoma
Barnsdall — McFaddin, Texas

1949

Texas Co. — Archer City, Texas
Baldridge & King — San Pablo, Texas
Lion — Shuler, Arkansas
Barnsdall — Placedo, Texas
Barnsdall & Sterling — Bloomington, Texas
Reno — Geraldine, Texas

1950

General Crude — Dayton, Texas
Del Rey — Chesterville, Texas
Mid-Valley — Clarkson, Kentucky
Pecos — Orla, Texas
Humble — South Mayes, Texas

1951

Pan American — Willamar, Texas
General Crude — Dayton, Texas
T G T — East Bernard, Texas
Texas Co. — Snyder, Texas
Del Rey — Chesterville, Texas
Sunray — Placedo, Texas

1952

Mid-Valley — Clarkson, Kentucky
General Crude — Clairemont, Texas
E P N G — Orla, Texas
T G T — East Bernard, Texas
T G T — Victoria, Texas
Humble — South Mayes, Texas
Texas Co. — Snyder, Texas
Del Rey — Chesterville, Texas
Shell — Gohlke, Texas

1953

Humble — Trawick, Texas
Texas Co. — Paradis, Louisiana
Sacroc — Snyder, Texas
Tennessee Production — Banquete, Texas
Tennessee Production — Chesterville, Texas
Warren — Fairbanks, Texas
E P N G — Orla, Texas

1954

Sunray — Ingleside, Texas
T G T — Fostoria, Texas
Magnolia — Pegasus, Texas
Texas Gulf Producing — Odessa, Texas
General Crude — Clairemont, Texas
Warren — Conroe, Texas
Sun — Sweetwater, Texas
Texas Co. — Paradis, Louisiana
Tennessee Production — Banquete, Texas
Tennessee Production — Chesterville, Texas

1955

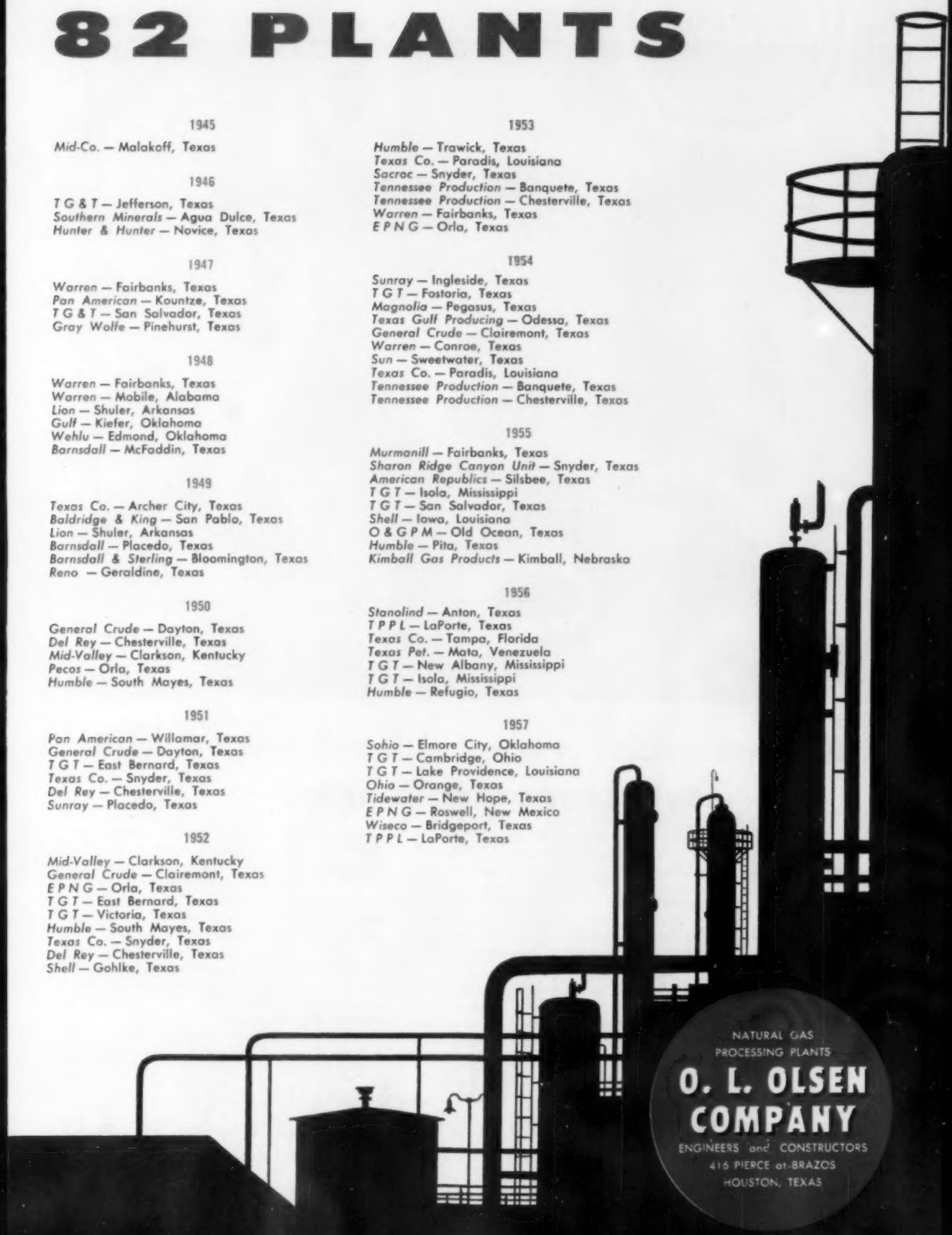
Murmanill — Fairbanks, Texas
Sharon Ridge Canyon Unit — Snyder, Texas
American Republics — Silsbee, Texas
T G T — Isola, Mississippi
T G T — San Salvador, Texas
Shell — Iowa, Louisiana
O & G P M — Old Ocean, Texas
Humble — Pita, Texas
Kimball Gas Products — Kimball, Nebraska

1956

Stanolind — Anton, Texas
T P P L — LaPorte, Texas
Texas Co. — Tampa, Florida
Texas Pet. — Mata, Venezuela
T G T — New Albany, Mississippi
T G T — Isola, Mississippi
Humble — Refugio, Texas

1957

Sohio — Elmore City, Oklahoma
T G T — Cambridge, Ohio
T G T — Lake Providence, Louisiana
Ohio — Orange, Texas
Tidewater — New Hope, Texas
E P N G — Roswell, New Mexico
Wiseco — Bridgeport, Texas
T P P L — LaPorte, Texas



NATURAL GAS
PROCESSING PLANTS
O. L. OLSEN COMPANY
ENGINEERS and CONSTRUCTORS
415 PIERCE at BRAZOS
HOUSTON, TEXAS

NATURAL-GASOLINE-PLANT SURVEY (California continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Richfield, Orange (Placentia)	3	1.7	.....	.....	7,000
Bell, Los Angeles (Santa Fe Springs)	12	8.8	.....	.....	40,000
Dominguez, Los Angeles (Compton)	18	15.6	.....	.....	50,000
Rosecrans, Los Angeles (Los Angeles)	9	6	.....	.....	17,000
Playa del Rey, Los Angeles (Venice)	3.9	3.5	.....	.....	5,500
Sansinena, Los Angeles (Whittier)*	4	3.4	.....	.....	8,500
Orcutt, Santa Barbara (Orcutt)	6	5.6	18,000	8,000	.....
Santa Maria, Santa Barbara (Santa Maria)	30	27	30,000	30,000	.....
Coalinga, Fresno (Coalinga)*	30	22.3	27,000	40,000	.....
Belgian Anticline, Kern (Taft)	3	2.7	.....	.....	6,000
Del Valle, Ventura (Saugus)	32	19.9	21,000	27,000	.....
Grimes Canyon, Ventura (Santa Paula)	3.5	2.3	.....	.....	3,000
West Mountain, Ventura (Santa Paula)	4	2.6	.....	.....	2,500
West Coast Refining Co.:					
Richfield, Orange (Placentia)	35	6	.....	.....	26,000
Wilmington Gasoline Co.:					
Long Beach†	.....	.....	.....	.....	86,000
Total	1,767.7	1,076.9	1,194,388	889,718	1,195,261

Colorado

California Co., The:					
Rangely, Rio Blanco (Craig)*	50	50	33,500	39,300	.....
Continental Oil Co.:					
Little Beaver, Washington (Brush)	10	9.8	24,787	27,594	.....
Ginther, Warren & Ginther:					
Sterling (two plants)†	.....	.....	.....	.....	215,000
Kansas-Nebraska Natural Gas Co.:					
Julesburg Basin, Logan (Deerfield)†	4.1	.....	.....	.....	5,423
Mountain Fuel Supply Co.:					
Hiawatha (Moffat)	15	12	.....	.....	1,000
Powder Wash (Moffat)	15	13	.....	.....	3,400
Pure Oil Co.:					
Adena (Morgan)	20	19	26,000	42,000	.....
Total	114.1	103.8	84,287	108,894	224,823

Illinois

Carter Oil Co.:					
Loudon, Fayette (St. Elmo)	14	2.6	5,200	17,000	.....

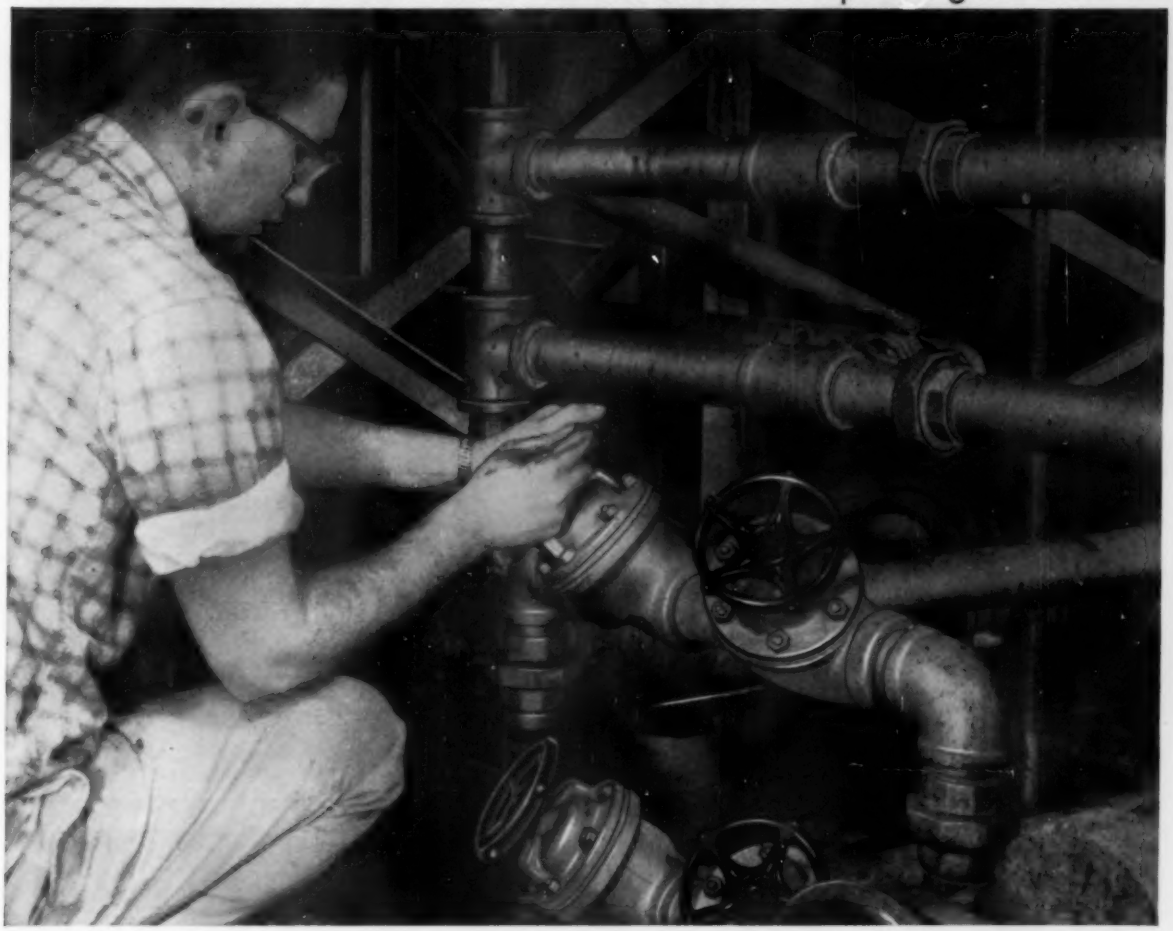
Illinois (continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
MacDonell Co. of Lima, Inc. (formerly Brenneman & MacDonell):					
Sarah Dee, Crawford (Oblong)	0.1	(‡)	.....	.....	60
National Petro-Chemicals Corp.:					
Tuscola, Douglas	500	485	26,000	570,000	.....
Texas Co., The:					
Hoodville, Hamilton (McLeansboro)	7	(‡)	¶14,000	¶63,000	.....
Salem, Marion (Salem)	6	(‡)	¶26,500	¶74,000	.....
Warren Petroleum Corp.:					
Plant No. 23 (Crossville)	6	6	10,000	36,000	.....
Total	533.1	493.6	81,700	760,000	60

Kansas

Cabot Carbon Co.:					
Sturgis E. Purdy, Texas (Elkhart)	2.5	1	.....	.....	161
Cities Service Oil Co.:					
Various, Sedgwick (Wichita)	120	109	43,000	34,000	.....
Burrton-Stone, Reno (Burrton)	5	4	7,000	8,000	.....
Colorado Interstate Gas Co.:					
Hugoton, Kearney (Lakin)	215	74	.....	.....	15,255
Dunn-Mar Oil & Gas Co.:					
Otis, Rush (Otis)	5	1.1	3,400	600	.....
Hugoton Production Co.:					
Hugoton, Grant (Ulysses)	90	64	20,000	29,000	.....
Kansas-Nebraska Natural Gas Co., Inc.:					
Hugoton, Kearney (Deerfield)†	125	.....	10,370	3,270	.....
Kansas Power & Light Co.:					
Barber (Medicina Lodge)†	48	.....	.....	.....	¶15,000
Magnolia Petroleum Co.:					
Hickok, Grant (Ulysses)	134	73.9	19,641	23,082	.....
Northern Natural Gas Co.:					
Hugoton, Seward (Sublette)	325	193	.....	.....	35,500
Hugoton, Finney (Holcomb)	185	110	.....	.....	13,000
Pan American Petroleum Corp. (formerly Stanolind Oil & Gas Corp.):					
Hugoton, Grant-Stanton-Morton-Stevens (Ulysses)	325	178	86,000	197,000	.....
Panhandle Eastern Pipe Line Co.:					
Hugoton, Seward (Liberal)	240	225.2	59,832	39,107	.....
Skelly Oil Co.:					
Kingman County*	4	(‡)	.....	.....	¶10,000
Barber County	40	(‡)	.....	.....	¶12,000
Texas Co., The:					
Atlanta, Cowley (Burden)*	3.4	(‡)	¶63,000	¶3,700	.....
Total	1,866.9	1,033.2	312,243	337,759	100,916

Another satisfied user of Crane Diaphragm valves



Best by test for this heavy, sticky emulsion —Crane diaphragm valves

What valve is best and lasts longest in this service? A West Coast emulsified asphalt producer tried them all on the manifold above and here's what was found.

Conventional valves would become inoperative in a short time. The main trouble was binding of the stem in contact with the cold, heavy asphalt emulsion.

Ordinary diaphragm valves on the same service lasted only two months and had to be replaced. The diaphragms didn't stand up and the high torque required for closure was impractical for frequent operation.

Three years ago the plant started using Crane No. 1610 Packless Diaphragm Valves. The neoprene diaphragm functions only to seal the bonnet. It is not subject to crushing and excessive wear as a seating member. The separate disc in combination with Crane Y-pattern body makes positive closure with minimum torque and turns. These valves are giving full satisfaction.

Literature on Request

Wide choice of body and diaphragm materials makes these exclusive Crane valves particularly useful to process industries. Ask your Crane Representative for Circular AD-1942, or write to address below.

CRANE VALVES & FITTINGS

PIPE • PLUMBING • KITCHENS • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

NATURAL-GASOLINE-PLANT SURVEY

Kentucky

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Ashland Oil & Refining Co.:					
Big Sinking Lee (Beattyville)	0.7	0.1	.....	.....	1,060
Kentucky West Virginia Gas Co.:					
Dwale, Floyd	40	35	.....	.....	8,000
Tennessee Gas Transmission Co.:					
Dwale, Floyd†	950	....	50,000 (Stripping)	375,000	.....
United Fuel Gas Co.:					
Boyd†	100	....	¶25,000	¶30,000	.....
Martin†	40	....	¶15,000	¶25,000	.....
Total	1,130.7	35.1	90,000	430,000	9,060

Louisiana

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Amerada Petroleum Corp.:					
Lake Chicot, St. Martins (Baton Rouge)	2.5	1.7	.....	.....	1,899 (34 lb. R.v.p.)
Anchor Gasoline Corp.:					
Avoyelles, Eola	30.5	(‡)	13,300	12,200	.....
Evangeline, Easton	13.5	(‡)	7,700	6,200	.....
Acadia, Eunice	27	(‡)	5,000	13,000	.....
Anse LaButte Gasoline Corp.:					
Anse LaButte, St. Martins†	....	....	.....	.....	12,000
Arkansas Fuel Oil Corp.:					
Homer, Claiborne (Homer)*	0.6	0.6	.....	.....	3,698
Arkansas Louisiana Gas Co.:					
Bistineau-Ada, Webster (Heflin)	60	48	.....	8,800	20,000 (Motor)
Ruston, Lincoln (Ruston)	60	35	9,800	14,200	.....
Rodessa, Caddo (Rodessa)	5	5	7,000	900	
Sligo, Bossier (Haughton)	60	33	.....	5,700	8,100 (Motor)
Atlantic Refining Co.:					
Neale, Beauregard (Merryville)*	22	15	12,600	9,900	.....
Bel Oil Corp.:					
North Elton, Allen (Elton)	35	25	18,000	2,000	.....
California Co., The:					
Hico-Knowles, Lincoln (Ruston)	75	25	.....	34,000	(Motor)
Claiborne Gasoline Co.:					
Lisbon, Claiborne (Shreveport)†	160	....	130,000	30,000	.....
Continental Oil Co.:					
Gillis, Calcasieu (Lake Charles)	97.8	90	.....	.....	93,740
Ville Platte, Evangeline (Ville Platte)*	120	62.8	.....	30,960 (Propane)	52,215
Gulf Oil Corp.:					
Homer, Claiborne (Homer)*	5	1.2	.....	.....	5,767
Humble Oil & Refining Co.:					
St. Landry (Opelousas)	180	180	59,640	68,800	.....
Hunt Oil Co.:					
Lisbon, Claiborne†	....	....	.....	.....	90,000

Louisiana (continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Magnolia Petroleum Co.:					
Mamou, Evangeline (Mamou)	7	2.8	6,996	4,901	.....
Hurricane Creek, Beauregard (Longville)	4	3.7	8,178	2,485	.....
Mississippi River Fuel Corp.:					
Morehouse (Monroe)†§	300	....	.....	.....	5,500
Shell Oil Co.:					
Iowa, Calcasieu (Iowa)	26	(‡)	11,400 (26 lb. R.v.p.)	.....	.....
Southwest Gas Production Co.:					
Dubach	190	120	.....	105,000	140,000
Sun Oil Co.:					
Delhi, Richland (Delhi)	17	12	25,000	40,000	.....
Texas Co., The:					
Lafitte, Jefferson (Lafitte)	22	(‡)	¶14,000		.....
Paradis, St. Charles (Paradis)	115	(‡)	¶36,500	¶59,000	.....
Tidewater Oil Co.:					
Venice, Plaquemines (Venice)	45	45	11,500	33,000	.....
Union Oil & Gas Corp. of Louisiana:					
South Lewisburg, Acadia (Church Point)	18	10	.....	.....	9,500
Welsh, Jefferson Davis (Welsh)	15	10	.....	.....	7,000
Whitton, E. A. (formerly Arkansas Louisiana Gas Co.'s plant):					
Shreveport, Caddo (Shreveport)	2	1.1	.....	.....	2,000
United Gas Pipe Line Co.:					
Sligo-Bistineau, Bossier - Webster (Houghton)	60	78	18,000	4,000	.....
Rodessa, Caddo (Vivian)	50	9	50,000	4,000	.....
Total	1,824.9	813.9	444,614	489,046	451,419

Michigan

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Dow Chemical Co.:					
Beaver Creek, Crawford (Grayling)	7	3	.....	.....	6,000

Mississippi

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
California Co., The:					
Brookhaven, Lincoln (Brookhaven)*	18	18	6,800	6,700	.....

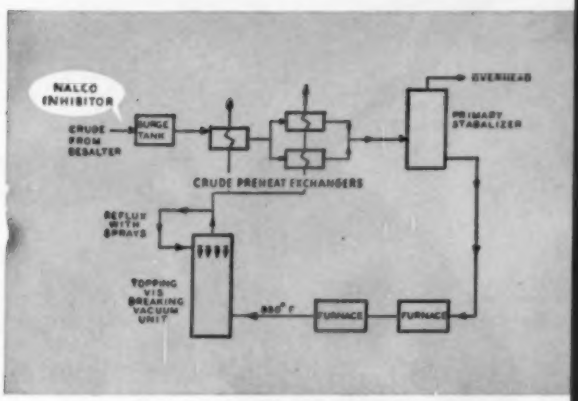
Montana

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Texas Natural Gas Corp. and Subsidiaries:					
Glendive plant (Glendive)	(‡)	(‡)	.....	.....	¶50,000
Union Oil Co. of California:					
Cut Bank, Glacier (Cut Bank)	60	50.7	10,000	13,000	.....
Total	60	50.7	10,000	13,000	50,000

Nalco INHIBITORS STOP CORROSION and FOULING

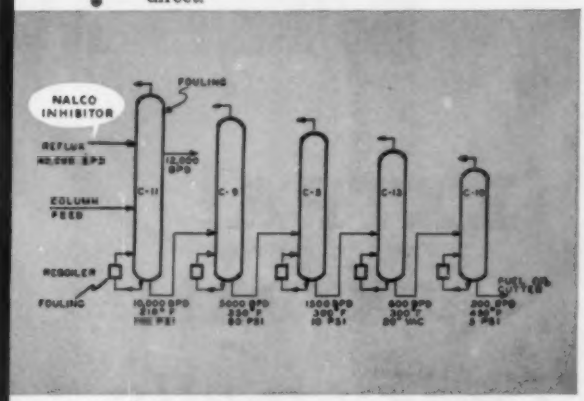
Every Step of the Way

HERE are four typical stages of refinery production where Nalco Inhibitors stop corrosion and fouling. There are many others, too. In fact Nalco Inhibitors are effective every step of the refinery way. Ask your Nalco Representative or write direct.



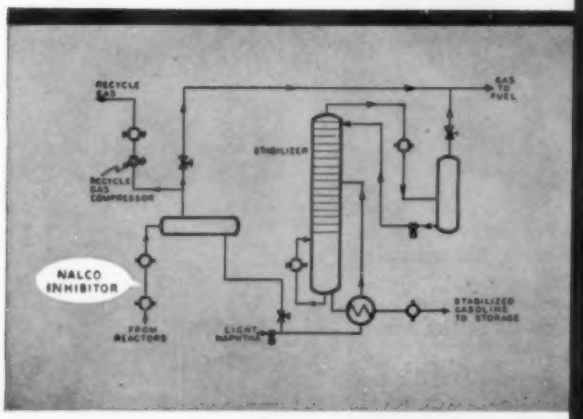
CRUDE PREHEAT EXCHANGERS

The Problem: Fouling. *The Treatment:* 15 ppm of Nalco Inhibitor. *The Results:* Normal temperatures regained in exchangers after five weeks of treatment. Actual reduction of 4 days of downtime due to cleaner condition of treated units.



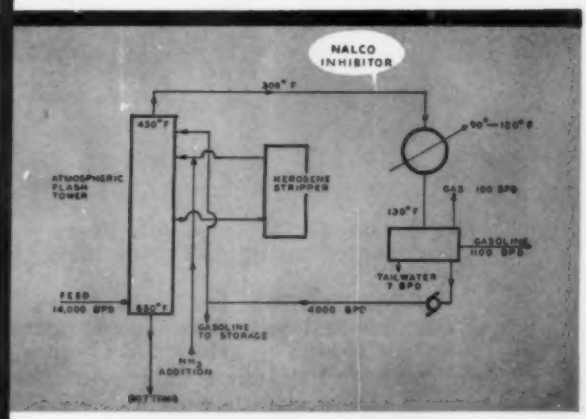
ALKYLATION SYSTEM

The Problem: Reboiler fouling. *The Treatment:* Nalco Inhibitor fed to reflux of tower C-11. *The Results:* No water washing or mechanical cleaning of system needed after full year of operation. Refinery costs and inconvenience reduced considerably. Greater production realized.



PLATINUM REFORMING UNIT

The Problem: Severe corrosion of exchangers and accumulator after the reactors due to an unusually high halogen acid contamination which held pH about 1.3. *The Treatment:* Nalco Inhibitor into reactor effluent. *The Results:* Iron content reduced from 13.9 to low of 0.73 lbs. per day, far lower than with other inhibitors at greater dosage.



DELAYED COKING UNIT

The Problem: Corrosion of overhead condenser, accumulator and stream pumps. Small amounts of iron sulfide "scaling" in flash tower. *The Treatment:* Nalco Inhibitor added to overhead stream. *The Results:* Iron content of tail water reduced from 300-1000 ppm to approximately 1-20 ppm. Corrosion and scaling stopped.

NATIONAL ALUMINATE CORPORATION

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Telephone: POrtsmouth 7-7240
CANADA: Alchem Limited, Burlington, Ontario
NORTHWESTERN UNITED STATES, HAWAII and ALASKA
The Flox Company, Inc., Minneapolis 3, Minnesota
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EXTRA!

EXTRA!

"Leaky wells lose money"

Is this news? Of course not. Every producer knows the importance of having leak-proof tubing joints in his pumping wells.

YOUNGSTOWN knows it, too. That's why we pay particular attention to thread tolerances and joint make-up in the manufacture of all Youngstown Oil Country Tubing.

Youngstown Seamless Tubing—available in H-40, J-55 and N-80 grades—is produced with either non-upset or external upset ends. Youngstown quality-controls all its integrated operations from ore mine to finished product—which assures you long, trouble-free field performance.

When you need Tubular Engineering Service or additional information, contact your nearest Youngstown Sales Office. You will find our Field Engineers as near as your telephone. Why not call today?

QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

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District Sales Offices in Principal Cities

NATURAL-GASOLINE-PLANT SURVEY

Nebraska

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Kimball Gas Products Co.:					
Long-Enders-Dietz (Kimball)†	7.5	....	.....	.....	46,000
Ohio Oil Co.:					
Huntsman, Cheyenne (Sidney)	12.5	8.9	8,962	20,216	.....
West Sidney, Cheyenne (Sidney)	12.5	7.2	6,705	13,896	.....
Total	32.5	16.1	15,667	34,112	46,000

New Mexico

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Atlantic Refining Co.:					
Denton, Lea (Lovington)	22	22	29,800	99,000	.....
El Paso Natural Gas Co.:					
Jal No. 1, Lea (Jal)	100	(‡)	32,000 (26 lb. R.v.p.)	10,500	.....
Jal No. 2, Lea (Jal)	50	(‡)	67,699	73,166	.....
Jal No. 3, Lea (Jal)	50	(‡)	(Remote absorbers only. Rich oil piped to Jal No. 2)		
Jal No. 4, Lea (Jal)	183	(‡)	86,000	56,080	.....
Blanco, San Juan, (Farmington)	70	(‡)	25,618	28,726	.....
Blanco, San Juan (Bloomfield)	552	(‡)	(Absorption only. Product piped to Wingate fractionation plant)		
Wingate, McKinley (Gallup)	.....	.....	314,133	392,815	.....
Frontier Natural Gas Co.:					
Grayburg-Jackson, Eddy (Loco Hills)	7	6.5	6,000	16,000	16,000
Gulf Oil Corp.:					
Eunice, Lea (Eunice)	55	48.6	34,611	82,092	.....
Maljamar Co-op Repressuring Agreement:					
Maljamar, Lea*	10.8	9.7	7,298	17,513	.....
Permian Basin Pipeline Co.:					
Lea, Lea (Hobbs)	156	156	57,500	36,000	.....
Phillips Petroleum Co.:					
Eunice, Lea (Oil Center)	82	(‡)	.....	.....	¶100,000
Hobbs-Vacuum, Lea (Hobbs)	41	(‡)	.....	.....	¶81,000
Skelly Oil Co.:					
Lea	128	(‡)	.....	.....	¶285,000
Southern Union Gas Co.:					
Kutz Canyon, San Juan (Bloomfield)	20	20	7,194	16,643	.....
Valley Gas Corp.:					
Loco Hills, Eddy (Artesia)*	6	5.5	10,000	30,000	.....
Anderson Ranch, Lea	4	4	.....	.....	25,000
Warren Petroleum Corp.:					
Plant 18, Monument	(‡)	71	34,000	68,000	.....
Plant 46, Lovington	(‡)	34	33,000	72,000	.....
Total	1,536.8	377.3	744,853	998,535	507,000

North Dakota

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Signal Oil & Gas Co.:					
Tioga-Beaver Lodge, Williams (Tioga)	65	39	22,000	116,000	.....

Ohio

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Ohio Fuel Gas Co.:					
York plant (Medina)†	15	.....	.....	.....	2,500
Quaker State Oil & Refining Corp.:					
Ohio (Saltillo)*	(‡)	0.2	.....	.....	.....
Total	15	0.2	.....	.....	2,500

Oklahoma

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Apache Gasoline Co.:					
West Brook, Carter (Ardmore)	4	2.5	5,000	7,500	.....
Boswell-Frates Co.:					
Norfolk, Payne (Cushing)	1.6	1.5	.....	.....	1,000
Edna, Creek (Edna)	2	1.5	.....	.....	1,500
Carter Oil Co.:					
Fitts, Pontotoc (Fittstown)	9	5.6	9,800	17,700	.....
Champlin Oil & Refining Co. (formerly The Chicago Corp.):					
Witcher, Oklahoma (Oklahoma City)	30	25	46,200	16,506	28,980
Cities Service Oil Co.:					
Oklahoma City, Oklahoma (Oklahoma City)	7	5	6,000	4,000	.....
Hugoton, Texas (Guymon)	(Drip control. Gas processed elsewhere)		.....	.....	9,000
Various, Kay (Blackwell)	230	230	53,000	137,000	.....
Dorchester Corp.:					
Guymon-Hugoton, Texas (Hooker)	125	60	12,000	51,000	.....
Eason Oil Co.:					
(Crescent)	14	8.5	7,700	13,500	.....
Frame Natural Gasoline Co.:					
Osage (Cleveland)†	.....	.....	.....	.....	2,000
Gasoline Plant Management (Operator of Lucien Unit Plant):					
Lucien, Noble (Perry)	8	8	7,000	17,000	.....
Garber, Inc. (Sterling Gasoline Plant):					
Spring Valley, Garfield (Garber)†	15	.....	12,000	6,000	.....
Grimes Gasoline Co.:					
Wetumka, Hughes (Wetumka)	15	10	4,000	2,000	.....
Grimes & Grimes:					
Weleetka, Okfuskee (Weleetka)	15	14	8,000	2,500	.....
Okemah, Okfuskee (Okemah)	1	0.5	.....	.....	1,000
Otha H. Grimes:					
Pauls Valley, Garvin (Pauls Valley)	5	2.5	5,000	6,000	.....
Gulf Oil Corp.:					
Altus, Jackson (Altus)	1.6	0.6	.....	.....	681

NATURAL-GASOLINE-PLANT SURVEY (Oklahoma continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Highway Gasoline Co.:					
Middle Peck, Lincoln (Stroud)	5	3	4,000	5,000	.....
Hugoton Plains Gas & Oil Co.:					
Hugoton, Texas (Tyron)	120	63	11,572	16,384	.....
Keener Oil Co.:					
Custer (Butler)	35	16	300	15,000	.....
Kerr-McGee Oil Industries, Inc.:					
Fitts, Pontotoc (Fittstown)	10	(‡)	4,000	4,000	.....
Milfay, Creek (Stroud)	15	(‡)	3,500	8,500	.....
Happy Valley, Lincoln (Cushing)	10	(‡)	2,000	5,500	.....
Lone Star Gas Co.:					
Katie, Garvin (Elmore City)	25	(‡)	.....	.....	20,000
Magnolia Petroleum Co.:					
Graham, Carter (Fox)	17.5	17.3	19,931	5,306	.....
Sholem-Alechem, Stephens (Countyline)	43	31	44,744	49,000	.....
Moran Gasoline Co.:					
Kendrick, Lincoln (Kendrick)	12	8	9,000	15,000	.....
Neal Gasoline Corp.:					
Osage	2	1.5	.....	.....	4,600
Patton & Swab:					
Edmond, Oklahoma (Edmond)	20	15	.....	.....	20,000
Phillips Petroleum Co.:					
Burbank, Osage (Shidler)	15	(‡)	.....	.....	¶36,000
Burbank, Osage (Fairfax)	8	(‡)	.....	.....	¶30,000
Edmond, Oklahoma (Edmond)	130	(‡)	.....	.....	¶190,000
Oklahoma City, Oklahoma (Oklahoma City)	16	(‡)	.....	.....	¶51,000
Wewoka, Seminole (Wewoka)	6	(‡)	.....	.....	¶16,000
Edmond, Oklahoma (Edmond)	65	(‡)	.....	.....	¶57,000
Bradley, Garvin (Lindsay)	60	(‡)	.....	.....	¶130,000
Pure Oil Co.:					
Sapulpa, Creek (Sapulpa)	4	4	.....	.....	5,400
Shell Oil Co.:					
Hewitt, Carter (Wilson)	6.1	(‡)	10,600 (18 lb. R.v.p.)	15,800	.....
Signal Oil & Gas Co.:					
Fox-Milroy, Carter (Healdton)	70	68	39,000	76,000	.....
Sinclair Oil & Gas Co.:					
Cushing, Creek (Drumright)	14	13	50,000	26,000	.....
Garber, Garfield (Covington)	50	28	26,000	34,000	.....
Plant 12, Seminole, Seminole (Seminole)	20	8	22,000	26,000	.....
Plant 13, Seminole, Seminole (Seminole)	15	8	41,000	28,000	.....
St. Louis, Pottawatomie (St. Louis)	14	11	24,000	39,000	.....
Skelly Oil Co.:					
Osage*	9	(‡)	.....	.....	30,000
Velma, Stephens	70	(‡)	.....	.....	120,000
Sohio Petroleum Co.:					
West Edmond, Kingfisher (Edmond)	8	7	2,990	2,024	.....
Eola, Garvin (Elmore City)	13	12	7,798	12,357	.....

Oklahoma (continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Sokla Gasoline Co.:					
Fox, Carter (Fox)†	5	....	4,159	4,865	.....
Sunray Mid-Continent Oil Co.:					
Moore, Clayton (Moore)	12	10	6,809	15,991	.....
Texas Co., The:					
Davenport, Lincoln (Davenport)	15	(‡)	¶14,700	¶25,000	.....
Warren Petroleum Corp.:					
Plant 15 (Maud)	(‡)	5	9,000	8,000	.....
Plant 22 (Madill)	(‡)	10	11,000	19,000	.....
Plant 33 (Maysville)*	(‡)	365	255,000	435,000	.....
Plant 40 (Ringwood)	(‡)	38	21,000	38,000	.....
Plant 57 (Marlow)	(‡)	8	3,500	1,500	.....
Total	1,422.8	1,125.0	823,303	1,210,933	754,161

Pennsylvania

Equitable Gas Co. and Subsidiaries:					
Rogersville, Greene (Rogersville)	28	25	.....	.....	2,363
Pennsylvania Gas Co.:					
Roystone, Sheffield (Warren)	11	6	.....	.....	3,000
Peoples Natural Gas Co., The:					
Brave, Greene (Waynesburg)	50	5	.....	.....	4,000
Quaker State Oil Refining Corp.:					
Jennings, Allegheny (Noblestown)	(‡)	0.11	.....	.....	22
Sproul, Allegheny (Noblestown)	(‡)	0.02	.....	.....	20
Total	89	36.13	.....	.....	9,405

Texas

Amarillo Oil Co.:					
West Panhandle, Potter, Fain Plant (Masterson)	100	95	30,000	10,000	.....
West Panhandle, Potter, Turkey Creek Plant (Fritch)	100	80	18,000	16,000	.....
Arkansas Fuel Oil Corp.:					
East Texas, Gregg (Greggton)	10	5.9	.....	38,675	41,626
Carthage, Panola (Carthage)	100	68.6	.....	32,915	46,310 (Motor)
Arkansas Louisiana Gas Co.:					
East Carthage, Panola (Carthage)	40	31	.....	14,500	24,100 (Motor)
Jefferson, Marion (Jefferson)	31	14	.....	7,400	12,700 (Motor)
Rodessa, Marion (Smithland)	15	7	3,600 (Reprocessed at Jefferson plant)	.....	.....
Waskom, Harrison (Waskom)	150	116	.....	45,500	122,900 (Motor)
Atlantic Refining Co.:					
Block 31, Crane (Crane)	45	45	.....	.....	16,300
Barnhart Hydrocarbon Corp.:					
Barnhart, Reagan (Big Lake)	25	18	12,000	40,000	.....

NATURAL-GASOLINE-PLANT SURVEY (Texas continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Black Hawk Gasoline Corp.:					
Alco-Graham, Jack (Graham)†	4.5	.....	5,000	2,600	.....
Bowie Gasoline Co.:					
Various, Montague (Bowie)	20	10	15,000	35,000	.....
Brazos River Gas Co. (formerly Upham Gas Co.):					
Various, Palo Pinto (Mineral Wells)	15	10	3,500	1,800	.....
Cabot Carbon Co.:					
Ward (Wickett)*	30	14	16,761	8,095	.....
Walton, Winkler (Kermit)	30	28	26,188	23,333	.....
Carthage Co.:					
Carthage, Panola (Carthage)	475	350	300,000	225,000	.....
Caska Corp.:					
Quitman, Wood (Quitman)	4	2	4,500	7,500	.....
Champlin Oil & Refining Co. (formerly The Chicago Corp.):					
Feazel-Kinsey, Panola (Carthage)†	210	.....	147,000	105,000	.....
Cities Service Oil Co.:					
Pampa, Gray (Pampa)*	37	37	67,000	28,000	.....
Chico, Wise (Chico)	25	17	11,000	38,000	.....
West Seminole, Gaines (Seminole)	15	13	14,000	33,000	.....
Coates, George H.:					
Tabasco, Hidalgo (La Hoya)	12	10	.....	.....	8,400
Jay Simmons, Starr (La Reforma)	2	1	.....	.....	2,300
Colorado Interstate Gas Co.:					
Panhandle, Moore, Fourway Plant (Dumas)	150	96	49,615	23,272	.....
Panhandle, Moore, Bivens plant (Dumas)	165	126	.....	.....	38,471
Coltexo Corp.:					
Panhandle, Gray (Lefors)	40	36.5	.....	.....	45,000
Continental Oil Co.:					
Rincon, Starr (Rio Grande City)*	20	20	25,014	7,811	
K.M.A., Wichita (Electra)*	10	9.1	.....	.....	70,863
Todd Ranch, Crockett (Big Lake)	9.3	4.7	11,937	19,008	.....
Delhi-Taylor Oil Corp.:					
Hagist Ranch, Duval	25	15	.....	.....	12,600
Delhi-Taylor Oil Corp. and Mayfair Minerals, Inc.:					
McAllen, Hidalgo	165	142.7	91,000	32,000	.....
Dorchester Corp.:					
West Panhandle, Carson (White Deer)	110	80	30,400	76,000	.....
Big Lake, Reagan (Texan) (formerly Texan Gas Co.)	8	5	.....	.....	12,000
El Paso Natural Gas Co.:					
Sealy-Smith, Ward (Monahans)	16.5	(‡)	16,536	25,200	.....
Midkiff-Spraberry, Reagan (Midland)	166	(‡)	208,033	343,687	.....
Etexas Producers Gas Co.:					
Chapel Hill, Smith (Tyler)	12	8	9,000	5,500	.....
Goliad Corp.:					
Kittie, Live Oak (Three Rivers)	130	130	42,000	65,000	.....
Hagist Ranch, Duval (Freer)	50	50	.....	.....	60,000
Wilcox Plant, Lavaca (Sheridan)	225	210	58,000	120,000	.....
Graridge Corp.:					
Plant 1, Shackelford (Albany)	10	7	4,000	4,000	.....
Plant 2, Eastland (Eastland)	10	5	6,000	9,000	.....
Plant 3, Young (Graham)	20	4	6,000	3,000	.....
Grimes, Otha H.:					
Ringgold, Clay (Ringgold)	2	0.6	2,500	2,000	.....
Eskota, Fisher (Trent)	1.5	1	2,500	3,500	.....
Gulf Oil Corp.:					
Waddell, Crane (Crane)	45	40.8	30,641	53,918	
Monahans, Ward (Wickett)	25	20.5	.....	.....	19,070
Runnels, Runnels (Wingate)	5	4.8	4,071	5,706	.....
Cashen, Rusk (Overton)	5	1.6	5,554	10,275	.....
Spear, Gregg (Kilgore)	15.5	7	30,144	53,647	.....
Henderson, Frank C., Trust No. 2:					
West Panhandle, Hutchinson (Sanford)	50	35	.....	.....	25,000
Honolulu Oil Corp. (owned jointly with Signal):					
Ropes, Hockley (Smyer)	2	1	2,300	7,100	.....
Honolulu Oil Corp. (owned jointly with B. G. Byars, A. G. Hill, N. B. Hunt, L. C. Johnston, B. W. Payne):					
White Flat, Nolan (Trend)	8	7	8,600	29,000	.....
Houston Hydrocarbon Corp.:					
Cordova Lake, Crane	10	(‡)	(‡)	(‡)	(‡)
Howsley, A. M., et al.:					
Glen Cove, Jennings (Coleman)*	1.8	1.6	2,000	2,500	.....
Huber, J. M., Corp.:					
Panhandle, Hutchinson (Borger)	69	69	.....	.....	36,000
Humble Oil & Refining Co.:					
Anahuac, Chambers (Monroe City)	100	75	.....	.....	38,800
Clear Lake, Harris (Genoa)	125	102	.....	14,240	39,540
Conroe, Montgomery (Conroe)	29	24	.....	16,900	34,290
East Texas, Rusk (Overton)	23	13	38,290	125,980	.....
Flour Bluff, Nueces (Corpus Christi)	17	14	.....	.....	5,320
Heyser, Calhoun (Bloomington)	18	15	.....	.....	4,730
Jourdanton, Atascosa (Jourdanton)	26	22	13,320	14,090	.....
Pickton, Hopkins (Pickton)*	49	49	.....	61,185	33,110
Pledger, Brazoria (Dancigar)	190	180	.....	92,080	95,180 (Includes heavier products)
Tomball, Harris (Tomball)	46	45	.....	.....	29,700
Neches, Cherokee (Jacksonville)	9.5	6.7	.....	.....	36,520
Tom O'Connor, Refugio (Refugio)	135	131	29,500	21,330	.....
Joint Venture No. 4 (formerly Empire Oil of Texas):					
South Cowden, Ector (Odessa)†	4	.....	.....	.....	.....

Pipe of Tenite Butyrate cuts downtime

This pipe resists paraffin plugging

The problem of paraffin plugging is often completely eliminated with pipe made of Tenite Butyrate. The clean, smooth inner wall of this plastic pipe offers no toe-holds where paraffin can start accumulating. These smooth walls also provide up to 40% greater flow volume than does metal pipe for the same head loss. Result: less load on pumps.

Pipe made of Tenite Butyrate offers many other advantages, too. It resists corrosion caused by sour crudes, salt water and alkali soils. It is extremely light in weight. One 20-foot length of 4" pipe made of Tenite Butyrate plastic weighs only 20 pounds—about one-sixth the weight of metal pipe of the same length and diameter. It is easily cut with a hand saw and joined quickly with only slip-sleeve couplings and solvent cement. Using this method, three unskilled men can lay 4,000 feet of 4" pipe in only one working day.

With Tenite Butyrate, you get a pipe line that is easily installed, that performs efficiently, and requires virtually no maintenance. You also get the substantial savings that accompany each of these advantages.

Write us for more information, as well as the names of companies that produce pipe and a complete range of fittings made of Tenite Butyrate. Address: EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

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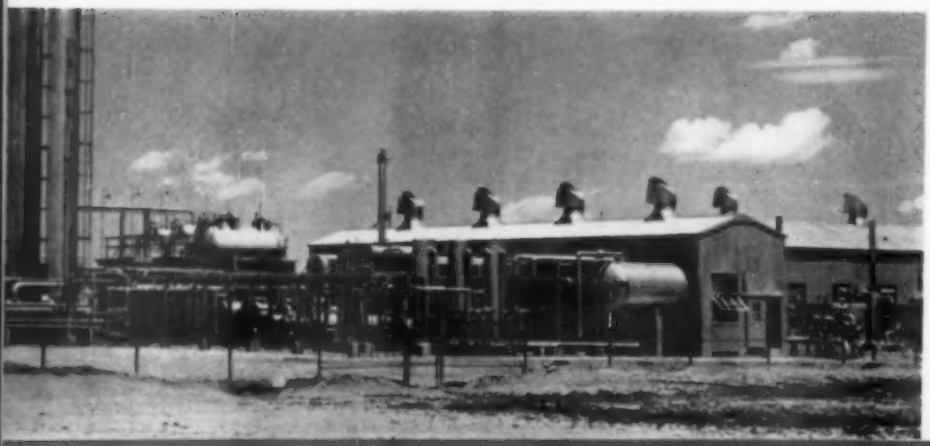
A 16-mm. sound-color film, "PLASTIC PIPELINES," is available upon request.

NATURAL-GASOLINE-PLANT SURVEY (Texas continued)

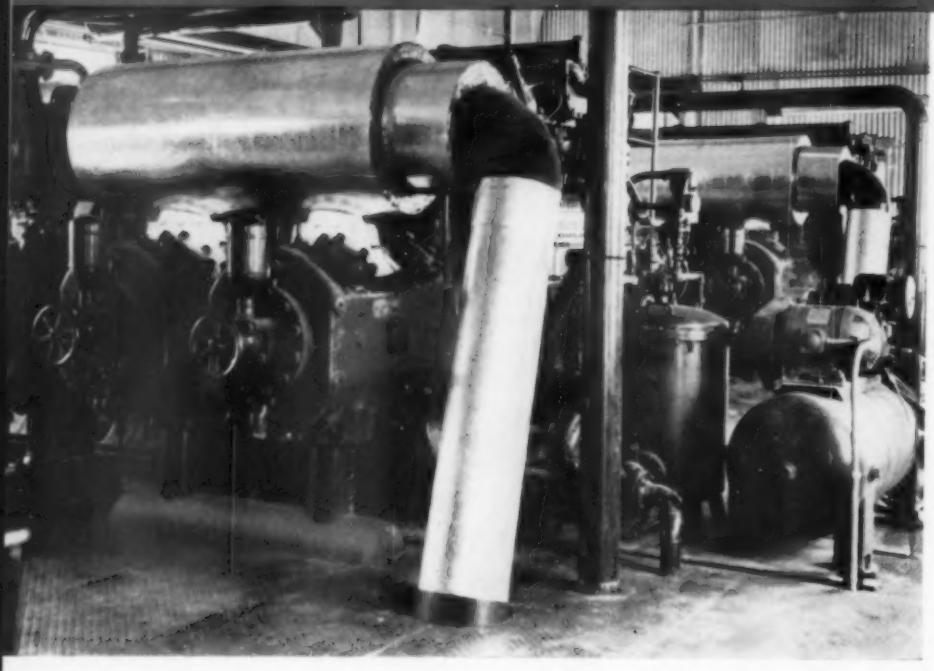
Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Kerr-McGee Oil Industries, Inc.:					
Gray (Pampa)	30	(‡)	30,000	28,000	.....
Moore (Cactus)	58	(‡)	20,000	40,000	.....
Lion Oil Co., Division Monsanto Chemical Co.:					
Diamond "M"-Sharon Ridge, Scurry (Snyder)	50	46	85,000	245,000	.....
Liquigas Co., The (formerly Stonewall Gas Products Co., Inc.):					
Katy, Stonewall (Knox City)	20	17	30,000	55,000	.....
Lone Star Gas Co.:					
Trinidad, Henderson (Trinidad)	240	(‡)	40,000	40,000	.....
Springtown, Parker (Springtown)	125	(‡)	30,000	70,000	.....
Gordon, Palo Pinto (Gordon)	75	(‡)	25,000	20,000	.....
Pueblo, Eastland (Cisco)	40	(‡)	.....	.....	7,000
Lone Star Producing Co.:					
McElroy-Wilshire, Upton (Crane)	15	(‡)	10,000	37,500	.....
Fort Chadbourne, Runnels (Bronte)*	30	(‡)	15,000	45,000	.....
RCF, Eastland (Ranger)	.....	.....	40,000	35,000	.....
Plant 108, Eastland (Ranger)	12	(‡)	.....	.....	60,000
Brooks, Stephens (Breckenridge)	6	(‡)	.....	.....	25,000
Magnolia Petroleum Co.:					
Burkburnett, Wichita (Burkburnett)	1.4	0.8	9,804	3,081	.....
Desdemona, Eastland (Desdemona)	1.3	1.3	5,994	3,250	.....
Electra, Wilbarger (Electra)	0.7	0.6	3,853	2,298	.....
Pegasus, Midland (Midland)	62.9	60	80,588	113,201	.....
Vanderbilt, Jackson (Vanderbilt)	89.6	80	35,588	11,706	.....
Sabine, Gregg (Kilgore)	8	5.2	22,133	41,237	.....
Kermit, Winkler (Kermit)	9.2	6.3	5,172	5,419	.....
Matagorda Corp.:					
Markham, Matagorda (Bay City)	(Condensate fractionating only)		.....	.....	80,000
Natural Gas Pipelines Co. of America:					
Panhandle, Hutchinson (Fritch)	192	126	150,627	8,681	.....
Panhandle, Moore (Stinnett)	160	172	156,616	9,000	.....
Natural Gasoline Corp.:					
Smith (Hawkins)	(‡)	20	26,000	84,000	.....
Odessa Natural Gasoline Co.:					
South Cowden-Foster, Ector (Odessa)	47	42	50,000	55,000	.....
Ohio Oil Co.:					
North Markham-North Bay City, Matagorda (Bay City)*	210	100	.....	65,137	65,137
Pan American Petroleum Corp. (formerly Stanolind Oil & Gas Co.):					
Luby-Petronilla, Nueces (Bishop)*	37	26	34,000	21,000	.....
North Cowden, Andrews-Ector (Odessa)*	60	48	71,500	93,500	.....
South Fulletron, Andrews (Andrews)*	55	49	63,000	271,000	.....
Slaughter, Cochran-Terry (Sundown)	110	90	121,000	175,000	.....
Levelland, Cochran - Hockley (Levelland)*	36	25	62,000	72,000	.....
Hastings, Brazoria - Galveston (Alvin)	53	53	28,000	32,000	.....
Three Bar, Andrews (Kermit)*	18	18	26,000	65,000	.....
Midland Farms, Andrews (Andrews)*	15	9	.....	.....	70,500
Parade Co., The:					
East Texas, Rusk (Overton)	12.5	9.1	38,150 (26 lb. V.T.)	17,910 (Butanes) 40,100 (Propane)	.....
Pecos Co.:					
Spraberry (Midland)†	33	.....	20,000	55,000	.....
Santa Rosa, Pecos (Grand Falls)†	35	.....	2,000	9,000	.....
Phillips Petroleum Co.:					
Chocolate Bayou, Brazoria (Alvin)	360	(‡)	.....	.....	¶330,000
West Panhandle, Moore (Phillips)	176	(‡)	.....	.....	¶220,000
Gray Plant, East Panhandle, Gray (Pampa)	80	(‡)	.....	.....	¶110,000
Lefors Plant, East Panhandle, Gray (Pampa)	54	(‡)	.....	.....	¶50,000
North Plant, East Panhandle, Gray (Pampa)	5.5	(‡)	.....	.....	¶40,000
Pampa Plant, East Panhandle, Gray (Pampa)	25	(‡)	.....	.....	¶75,000
Canadian Plant, West Panhandle, Hutchinson (Phillips)	18	(‡)	.....	.....	¶80,000
Pantex Plant, West Panhandle, Hutchinson (Phillips)	30	(‡)	.....	.....	¶65,000
Rock Creek Plant, West Panhandle, Hutchinson (Phillips)	240	(‡)	.....	.....	¶180,000
Sanford Plant, West Panhandle, Hutchinson (Phillips)	85	(‡)	.....	.....	¶110,000
Sneed Plant, West Panhandle, Moore (Phillips)	260	(‡)	.....	.....	¶195,000
Hansford Plant, West Panhandle, Hansford (Guymon, Okla.)	140	(‡)	.....	.....	¶106,000
Sherman Plant, West Panhandle, Hansford (Guymon, Okla.)	380	(‡)	.....	.....	¶220,000
McElroy, Crane (Crane)	52	(‡)	.....	.....	¶180,000
Goldsmith, Ector (Goldsmith)*	285	(‡)	.....	.....	¶650,000
Fullerton, Andrews (Andrews)*	75	(‡)	.....	.....	¶150,000
Harper - Penwell - Jordan, Ector (Penwell)	39	(‡)	.....	.....	¶75,000
Seminole, Gaines (Seminole)	25	(‡)	.....	.....	¶57,000
Tex-Harvey, Midland (Spraberry)	48	(‡)	.....	.....	¶120,000
Pembrook, Upton (Midkiff)	48	(‡)	.....	.....	¶150,000
Various, Andrews (Andrews)	85	(‡)	.....	.....	¶350,000
Plymouth Oil Co.:					
Susan Peak, Tom Green (San Angelo)*†	3	.....	.....	.....	2,400

Another example of efficient power at lower cost

In the Denver-Julesburg Basin ... multiple service ... multiple advantages with portable **COOPER-BESSEMERS**



This modern plant in the Denver-Julesburg Basin contains eight Cooper - Bessemer 500 hp GMXA's totaling 4,000 reliable compressor horsepower.



Shown here from the compressor cylinder side, GMXA's hard at work in the Little Beaver "dry" gasoline plant.

One of the 8-cylinder Cooper-Bessemers compressing low pressure gas for the production of propane, butane and gasoline.

ENGINES: GAS • DIESEL • GAS-DIESEL COMPRESSORS: RECIPROCATING AND CENTRIFUGAL, ENGINE OR MOTOR DRIVEN

BRANCH OFFICES: New York • Chicago • Washington • San Francisco • Los Angeles • Houston • Dallas • Odessa • Pampa • Greggton Seattle • Tulsa • St. Louis • Kansas City • Minneapolis • Gloucester • New Orleans • Shreveport • Great Falls

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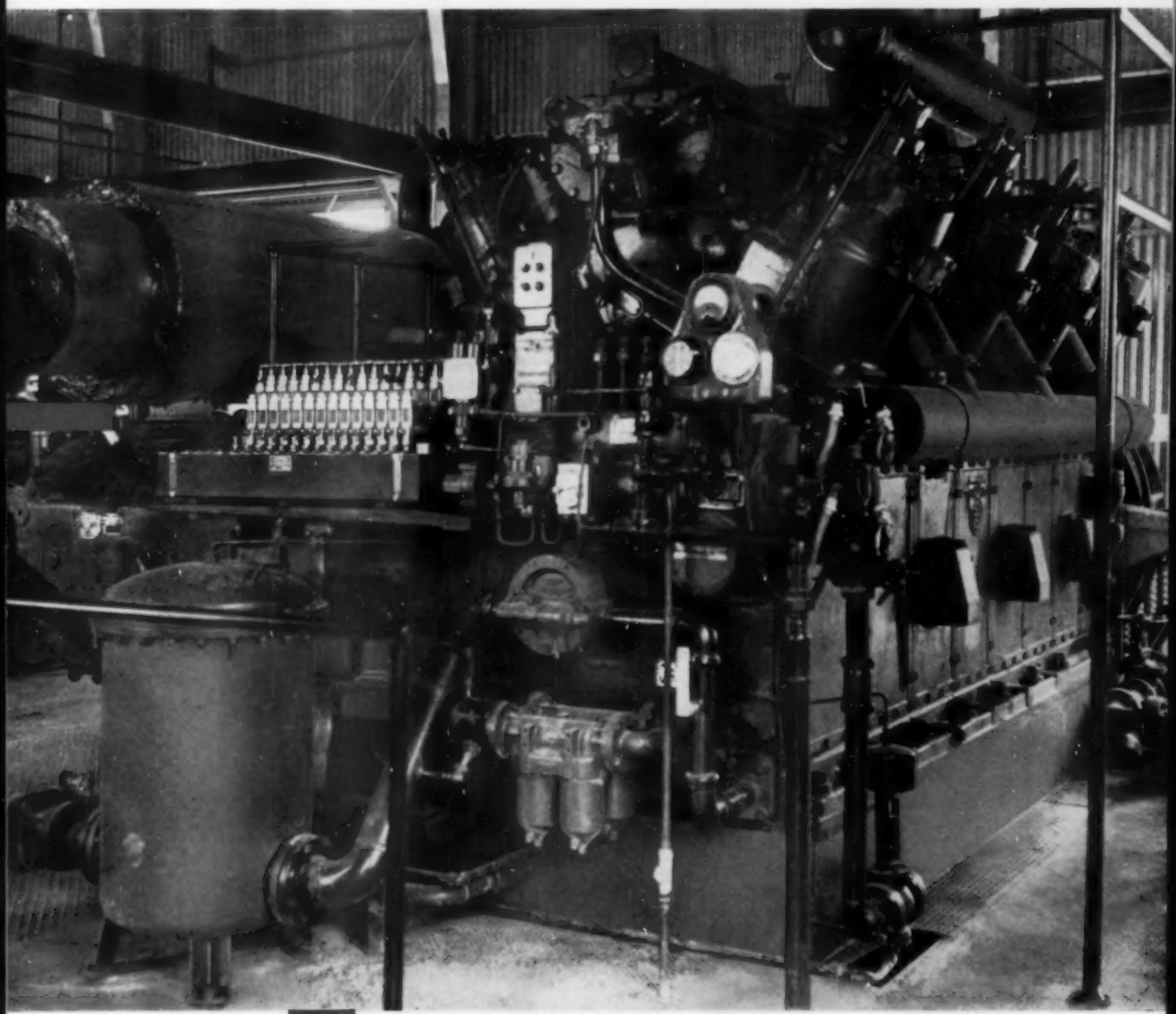
● Offering unmatched economy in all phases of operation . . . Cooper-Bessemer GMXA compressors efficiently handle eight to ten million cubic feet of low pressure gas per day in the Little Beaver "dry" gasoline plant, Morgan County, Colorado.

Operated by Continental Oil, and owned by a number of companies, this plant in the Denver-Julesburg Basin is connected to a system of 169 wells. Six portable GMXA's, rated 500 hp at 400 rpm, handle three stage gas compression from 1 to 865 psig. Two additional Cooper-Bessemers are used for refrigeration and recompression service.

If your future plans include engines or compressors in the 200 to 5000 hp range . . . for the usual, or the very unusual . . . you'll profit from a call to the nearest Cooper-Bessemer office. Cooper-Bessemer equipment has long been recognized for handling *all* types of jobs with minimum difficulty and continuing economy, even after many years of severe service.



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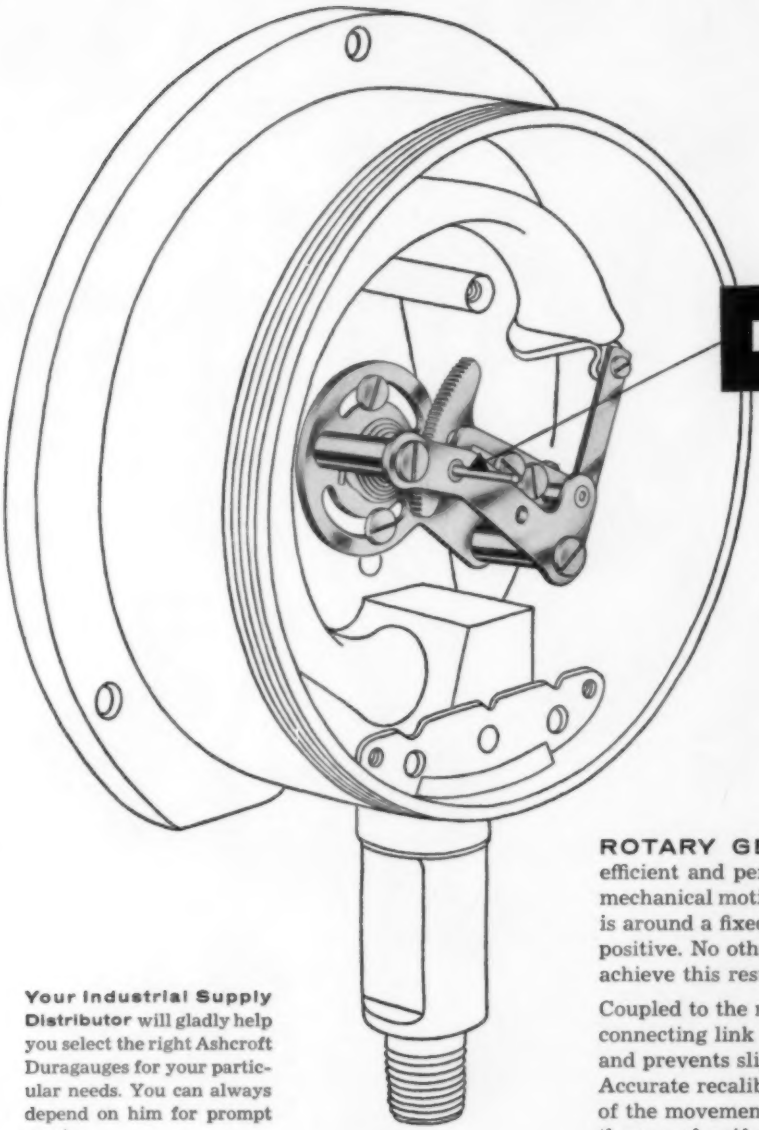
MOUNT VERNON, OHIO • GROVE CITY, PENNA.

NATURAL-GASOLINE-PLANT SURVEY (Texas continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Pure Oil Co.:					
Dollarhide, Andrews	65	61.7	105,000	122,000	.....
Van, Van Zandt (Van)	15	7.1	40,000	17,000	.....
Reef Fields Gasoline Corp.:					
East Vealmoor, Howard (Big Spring)	38	38	75,000	225,000	.....
Renwar Oil Corp.:					
Mustang Island, Nueces (Corpus Christi)	50	(‡)	.....	.....	35,000
Richardson, Sid, Gasoline Co.:					
Keystone, Winkler (Kermit)	140	100	45,000	100,000	.....
Rowan & Hope:					
Strawn Reef, Nolan (Sweetwater)†	5	.....	4,000	1,000	.....
Runnels Gas Products Corp.:					
Cree Sykes-Goldsboro, Runnels (Winters)	21	30	25,000	55,000	.....
Rycade Oil Co.:					
Emperor, Winkler (Wink)†	15	.....	6,000	6,000	.....
Shamrock Oil & Gas Corp.:					
Panhandle, Moore (Sunray)	400	330	110,000	260,000	.....
Shell Oil Co.:					
TXL, Ector (Notrees)	69	(‡)	83,000 (26 lb. R.v.p.)	114,000	.....
Wasson, Yoakum (Denver City)	120	(‡)	.....	101,000	173,000 (42 lb. R.v.p.)
Panhandle, Carson (Skellytown)	14	(‡)	.....	.....	27,300 (60 lb. R.v.p.)
Provident City, Lavaca (Sheridan)	65	(‡)	70,400	14,500	.....
Sinclair Oil & Gas Co.:					
East Texas, Gregg (Longview)	17	10	32,000	109,000	.....
East Texas, Rusk-Smith (Troup)	20	7	14,000	14,000	.....
East White Point, San Patricio (Taft)	21	18	16,000	7,000	.....
East Texas, Rusk (Price)	17	8	15,000	25,000	.....
Sweetwater Canyon, Nolan (Sweetwater)	6	3	5,000	4,000	.....
Hulldale, Schleicher (El Dorado)	16	13	4,000	15,000	.....
Silsbee, Hardin (Silsbee)	73	50	7,000	6,000	.....
South Hampton, Hardin (Silsbee)	25	20	2,000	1,000	.....
Bender, Montgomery (Spring)	6	4	.....	.....	700
Skelly Oil Co.:					
Hutchinson, Carson-Gray*	83	(‡)	.....	.....	340,000
Southern Minerals Corp.:					
Stratton, Nueces (Bishop)*	55	47	16,000 (26 lb. R.v.p.)	14,000	.....
Saxet, Nueces (Corpus Christi)	45	40	14,000 (26 lb. R.v.p.)	4,000	.....
Richard King, Nueces (Agua Dulce)*	6	5	.....	.....	.....
Standard Oil Co. of Texas:					
Sivells Bend, Cooke (Gainesville)	5	4	6,000	10,000	.....
Kelly-Snyder, Scurry (Snyder)	30	16	39,000	103,400	.....
Sherman, Grayson (Sherman)	16	20	7,000	25,000	.....
Sun Oil Co.:					
Jameson, Coke (Colorado City)*	55	55	50,000	60,000	.....
Sun, Starr (Delmita)	55	50	45,000	55,000	.....
Sunray Mid-Continent Oil Co.:					
Kelly-Snyder, Scurry (Snyder)	75	50	111,000	404,000	.....
Redfish Bay, Nueces (Corpus Christi)	180	175	33,400	113,600	.....
Superior Oil Co.:					
Rio Bravo, Kern (Shafter)*	30	(‡)	19,000	48,000	.....
Lake Creek, Montgomery (Conroe)	55	(‡)	52,500	52,416	.....
Ramsey, Colorado (Alleyton)	55	(‡)	(Operates as one unit with above plant)		
Tennessee Gas Transmission Co.:					
Eagle Lake, Colorado (Eagle Lake)	100	86	21,000	55,500	.....
Agua Dulce, Nueces (Banquete)	100	154	.....	.....	78,200 (Ethane excluded)
Holiday, Archer (Wichita Falls)*	6	2	.....	.....	3,100
Texas Co., The:					
Electra, Wichita (Electra)	2.2	(‡)	¶10,000	¶13,000	.....
Fuller, Scurry (Snyder)*	28	(‡)	¶60,000	¶100,000	.....
Texas Gas Corp.:					
Jefferson (Winnie)	200	200	.....	110,000	230,000 (Finished gaso., isopentane, range oil, gas oil)
Texas Natural Gasoline Corp. and Subsidiaries:					
Wimberly Plant (Tye)	(‡)	(‡)	.....	.....	¶100,000
Walnut Bend Plant (Gainesville)	(‡)	(‡)	.....	.....	¶40,000
Sandusky Plant (Whitesboro)	(‡)	(‡)	.....	.....	¶75,000
Benedum Plant (Rankin)	(‡)	(‡)	.....	.....	¶175,000
Pembrook Plant (Midkiff)	(‡)	(‡)	.....	.....	¶100,000
Weiner-Floyd (Midland)	(‡)	(‡)	.....	.....	¶100,000
Perkins Plant (Silver)	(‡)	(‡)	.....	.....	¶300,000
Texas Pacific Coal & Oil Co.:					
Caddo, Stephens	6	1.8	6,476	6,065	.....
Pardue-Toler, Fisher	5	1.8	2,960	7,408	.....
Tidewater Oil Co.:					
South Sinton, San Patricio (Sinton)	4	4	.....	.....	1,900 (Oil)
Cayuga, Anderson (Cayuga)	25	16	6,500	6,000	.....
West Bernard, Wharton (East Bernard)	32	30	20,000	7,000	.....
Yoward, Bee (Mineral)*	4	4	.....	.....	7,500 (Oil)
Turner & West Gasoline Co.:					
9 miles northwest Graham*	3	2	3,000	6,000	.....
6 miles north Loving*	1.5	1.5	2,000	4,000	.....
United Gas Pipe Line Co.:					
Agua Dulce, Nueces (Banquete)	30	30	45,000	4,000	.....
Cabeza Creek, Karnes (Runge)	100	105	27,000	57,000	.....



Why does the MOVEMENT in the ASHCROFT DURAGAUGE outperform all other types?

ROTARY GEARED MOTION, the most efficient and perfect method of transmitting mechanical motion ever developed. Because rotation is around a fixed center, pointer position is always positive. No other type of movement can ever achieve this result.

Coupled to the movement is a one-piece connecting link that guarantees correct calibration and prevents slippage or parting under tension. Accurate recalibration is easy from front or rear of the movement. Universal adjustability permits the use of uniformly graduated dials, thereby facilitating maintenance.

The Ashcroft Duragauge is available with all-stainless-steel movement or stainless steel with nylon bearings and pinion gear. There are case designs and materials, Bourdon tube materials, pressure ranges and dial sizes to meet your service conditions exactly. Save time, trouble and money. Specify the pressure gauges of highest sustained accuracy and durability – Ashcroft Duragauges.

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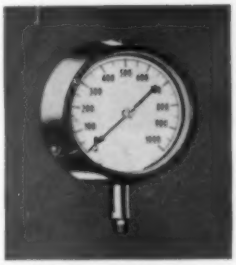


In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

ASHCROFT GAUGES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Oklahoma.* AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

NEW "SELF-SEALING" RING GASKET

Cameron has developed a new gasket for standard API flanges.

Internal pressure is used to assist in effecting a safe, sure seal with only a fraction of the bolt tightness needed by conventional API gaskets. This reduces nipple up time to a minimum and gives greatly increased protection against leakage resulting from drilling vibration, rough handling or test pressure loads. You can forget about frequent, time-consuming bolt retightening.

AN OPEN LETTER TO THE OIL TOOL INDUSTRY

Cameron is making the "Self-Sealing" Ring Gasket available to the industry.

Along with every other member of the industry, Cameron has been constantly concerned with the problem of maintaining tight API flange connections.

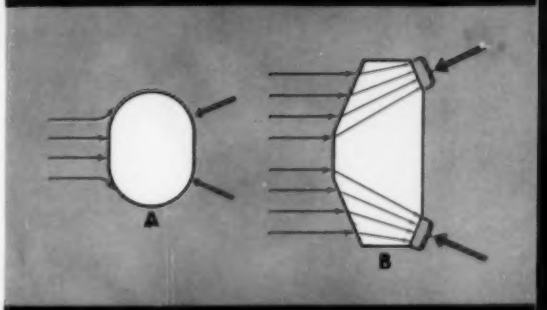
Difficulties and expense have long been experienced because stud bolts had to perform the double duty of holding pressure while keeping the gasket compressed.

The obvious answer to this problem is to use internal pressures rather than bolt loading to effect a seal.

Cameron, through extensive research and development, has produced the "Self-Sealing" Ring Gasket design. Increasing ring height and proportionately increasing loading by pressure on the outer face of the ring has created a self-sealing condition.

To the advantage of all concerned, Cameron is releasing this design to the industry without requiring license fees or manufacturers' royalties.

New "Self-Sealing" Ring first makes contact on this outer surface creating an initial seal. Even with wear on both ring and flange, low torque will effect a perfect seal. Increased pressure increases tightness of seal.



A. The small curved contact areas of the old style ring gasket effect a seal only with high bolt loading. Because they yield under load, continuous retightening is necessary. Internal pressure does not aid in maintaining a seal.

B. The "Self-Sealing" Ring Gasket utilizes the force of internal pressures to increase sealing effect over the two broad surfaces on its outside diameter. Contact areas with the flange groove are increased tremendously. The result is better sealing effect and much greater load carrying ability.

This view shows increased height of the new "Self-Sealing" Ring. Larger contact areas increase mechanical stability with low bolt loading.

"Self-Sealing" Ring Gaskets are manufactured in sizes to replace old style API rings from 6" 3,000 lb. through 14" 5,000 lb. All other standard sizes available on special order. These gaskets use standard stud bolts and nuts. "Self-Sealing" Ring Gaskets may be purchased directly from Cameron or from your regular source. In the event your source cannot make delivery on this new type "Self-Sealing" Gasket, please advise that complete specifications including all engineering data for their royalty-free manufacture may be obtained from Cameron at no cost whatsoever.

This self-sealing principle is also used in a tentative design for 15,000 lb. working pressure flanges.

Cameron

IRON WORKS, Inc.

P. O. Box 1212 — Houston, Texas

In England: Cameron Iron Works Ltd., Time & Life Bldg., New Bond Street, London W. 1 England

Five AAF Type P Cycoils deliver clean air to the big compressors at the Shelbyville, Indiana station.

New American Louisiana Pipeline Uses AAF Cycoils Exclusively to Protect Compressors

OVER 300,000,000 cubic feet of natural gas per day flow through the 979-mile American Louisiana Pipeline. Eight compressor stations—each developing 10,000 to 12,000 horsepower—provide the "push" for the 30 inch main line. Compressor equipment *must* stay on the job. That's why every one of the huge compressors at every station is protected against dirty air by AAF Cycoil Oil Bath Air Cleaners.

American Louisiana selected AAF equipment exclusively because AAF filters have proved their dependability in thousands of installations which demand uniform air delivery, constant efficiency, low operating resistance and infrequent maintenance.

Want more facts? Ask your AAF representative or write to American Air Filter Company, Engine and Compressor Division, Louisville 8, Kentucky.

AAF
Herman Nelson

American Air Filter
COMPANY, INC.

444 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

Type CMS Multi-Duty Filters

Type G Pipeline Air Filters

BETTER AIR IS OUR BUSINESS

Type OCH Intake Air Filters

Cycoil Oil Bath Air Filters

NATURAL-GASOLINE-PLANT SURVEY (Texas continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Carthage, Panola (Carthage)	220	208	304,000	76,000	.....
Coy City, Karnes (Karnes City)	40	33	35,000	15,000	.....
Waggoner, W. T., Estate:					
Wilbarger (Vernon)†	2	....	3,200	700	.....
Warren Petroleum Corp.:					
Plant 20, Fairbanks	(‡)	35	13,000	9,000	.....
Plant 27, Holliday*	(‡)	16.5	30,000	72,000	.....
Plant 28, McLean*	(‡)	23	28,000	26,000	.....
Plant 30, Breckenridge	(‡)	9.5	20,000	38,000	.....
Plant 31, Gladewater	(‡)	10	24,000	102,000	.....
Plant 47, Gregg-Tex	(‡)	10	23,000	82,000	.....
Waskom National Gas Corp.:					
Waskom, Harrison (Waskom)	60	35	.....	10,000	25,000
West Gasoline Co.:					
Hull, Liberty (Hull)†	20	....	20,000	15,000	.....
Whelan, D. E. & R. J.:					
Whelan, Harrison (Marshall)†	15	....	.....	.....	7,500
Woodlawn Processing Corp.:					
Woodlawn, Harrison (Marshall)	60	30	40,000	30,000	.....
Woodson Oil Co.:					
McKnight, Throckmorton (Woodson)*	1.3	0.5	.....	.....	.....
Manning-Harrington, Strawn (Throckmorton)*	(‡)	0.5	.....	.....	.....
Total	11,337.7	6,003.3	4,532,965	6,765,856	6,553,067

Utah

Mountain Fuel Supply Co.:					
Clay Basin (Daggett)	22	10	.....	.....	800

West Virginia

Hope Natural Gas Co.:					
Wetzel (Pine Grove)	300	123.1	35,085	79,058	.....
Lewis (Weston)	15	9.6	.....	.....	6,600
Pure Oil Co.:					
Kanawha (Cabin Creek)	3	2.8	3,600	1,000	.....
Quaker State Oil Refining Co.:					
Salem, Doddridge (West Union)*	(‡)	0.5	.....	.....	.....
Dents Run, Marion (Mannington)*	(‡)	0.7	.....	.....	.....
Mills, Wetzel (Jacksonburg)*	(‡)	1.1	.....	.....	180
Hoyt, Wetzel (Pine Grove)*	(‡)	0.1	.....	.....	.....
Big Moses, Tyler (Alma)*	(‡)	0.5	.....	.....	.....
Furbee, Tyler (Tyler City)	(‡)	0.5	.....	.....	.....
South Penn Natural Gas Co.:					
Marion (Mannington)	(‡)	(‡)	.....	.....	800
Lewis (Camden)	(‡)	(‡)	.....	.....	800
Clay (Newton)	(‡)	(‡)	.....	.....	2,500
Roane (Clova)	(‡)	(‡)	.....	.....	1,200

West Virginia (continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Monongalia (Fairview)	(‡)	(‡)	.....	.....	3,000
Ritchie (Brokard)	(‡)	(‡)	.....	.....	2,600
Harrison (Wolf Summit)	(‡)	(‡)	.....	.....	3,500
Marion (Mannington)	(‡)	(‡)	.....	.....	1,200
Wetzel (Smithfield)	(‡)	(‡)	.....	.....	3,000
Tyler (West Union)	(‡)	(‡)	.....	.....	500
Kanawha (Blue Creek)	(‡)	(‡)	.....	.....	500
Wetzel (Pine Grove)	(‡)	(‡)	.....	.....	3,500
Roane (Walton)	(‡)	(‡)	.....	.....	1,200
Harrison (Shinnston)	(‡)	(‡)	.....	.....	500
Tyler (West Union)	(‡)	(‡)	.....	.....	500
Tyler (West Union)	(‡)	(‡)	.....	.....	3,000
Tyler (West Union)	(‡)	(‡)	.....	.....	500
Gilmer (Grantsville)	(‡)	(‡)	.....	.....	3,000
Kanawha (Pinch)	(‡)	(‡)	.....	.....	500
Tyler (Middlebourne)	(‡)	(‡)	.....	.....	300
Tyler (Sistersville)	(‡)	(‡)	.....	.....	1,000
United Fuel Gas Co.:†					
Cabell	40	....	10,000	8,000	.....
Jackson	50	....	20,000	10,000	.....
Lincoln	40	....	12,000	28,000	.....
Kanawha	85	....	20,000	20,000	.....
Kanawha	35	....	12,000	8,000	.....
Kanawha	10	....	.....	.....	3,500
Total	578	138.9	112,685	154,058	43,912

Wyoming

Continental Oil Co.:					
Sussex, Johnson (Lynch)*	15.8	15	5,994	9,979	.....
Mobil Producing Co.:					
Manderson	15	8	400	30	.....
Mountain Fuel Supply Co.:					
Church Buttes (Uinta)	100	55	.....	.....	3,490
Mountain Valley Oil Co.:					
Clareton, Weston (Newcastle)†	5	....	.....	.....	10,000
Northern Utilities Co.:					
Sand Draw, Fremont (Riverton)	50	50	.....	.....	2,500
Ohio Oil Co.:					
McFadden, Carbon (Rock River)*	2.5	1.5	941	3,079	.....
Pan American Petroleum Corp. (formerly Stanolind Oil & Gas Co.):					
Elk Basin, Park-Carbon (Elk Basin)*	12	10	17,000	39,000	.....
Salt Creek, Natrona (Midwest)*	25	24	51,000	42,000	.....
Pure Oil Co.:					
Washakie (Worland)	42	42	17,000	40,000	.....
Sinclair Oil & Gas Co.:					
Sweetwater, Barroil	9	7	.....	.....	12,000
Total	276.3	212.5	92,335	134,088	27,990

NATURAL-GASOLINE-PLANT SURVEY

Alberta, Canada

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products: Natural gasoline (gal./day)	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
Anglo American Exploration, Ltd.:					
Turner Valley	25	7.5	.....	.....	5,000
British American Oil Co., Ltd.:					
Stettler	20	10	4,000	20,000	.....
Pincher Creek	60	60	.....	.....	2,000 (Cycling)
Westerose*	8	6	.....	.....	.....
Imperial Oil, Ltd.:					
Leduc	24	24	14,700	73,500	.....
Redwater	10	6	7,140	33,600	.....
Golden Spike	14	3	(Products recovered through compression forwarded to Leduc plant)		
Royalite Oil Co., Ltd.:					
Turner Valley	100	100	79,800	26,600	.....
Total	261	216.5	105,640	153,700	7,000

CYCLING-PLANT SURVEY

Kentucky, West Virginia Added to List; Oklahoma, Texas, Louisiana Show Gain

Journal Survey of U. S. Cycling Plants

State—	No. plants	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products: Total butane and lighter (gal./day)	Products: Comb. nat. gaso. and L.P.G. prod. stream (gal./day)
Arkansas	1	55	55	45,000	45,000
California	2	280	154	108,297	101,679
Kentucky	1	6	1	.....	307
Louisiana	15	1,100	565	482,833	1,539,557
Mississippi	1	112	112	23,000	42,000
Oklahoma	5	268	44	193,797	373,083
Texas	28	2,906	1,795	1,587,515	1,968,436
West Virginia	1	25	16	6,000	5,000
Total U. S.	54	4,752	2,742	2,446,442	4,075,062

CYCLING-PLANT SURVEY

Arkansas

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products: Total butane and lighter (gal./day)	Products: Combination nat. gaso. and L.P.G. prod. stream (gal./day)
McKamie Gas Cleaning Co.:				
McKamie-Patton, Lafayette (Lerch)	55	55	45,000	45,000

California

Ohio Oil Co.:				
South Coles Levee, Kern (Bakersfield)	75	70.1	42,250	37,641
Western Gulf Oil Co.:				
Paloma, Kern (Bakersfield)	150	28.7	21,047	19,038
Total	280	153.8	108,297	101,679

Kentucky

Ashland Oil & Refining Co., Inc.:				
Martha, Johnson (Martha)	5.5	0.7	.....	307

Louisiana

Acadia Corp.:				
Egan, Acadia (Egan)	120	110	60,000	100,000
Bel Oil Corp.:				
North Elton, Allen (Elton)†	14	.....	100	13,000
California Co., The:				
Lake St. John, Tensas-Concordia (Waterproof)	112	112	48,000	42,000
Cotton Valley Operators Committee:				
Cotton Valley, Webster (Cotton Valley)	150	150	126,000	294,000
Gulf Oil Corp.:				
Krotz Springs, St. Landry (Krotz Springs)	200	15.9	.....	15,477
Haynesville Operators Committee:				
Haynesville, Claiborne (Haynesville)	21	18.5	.....	20,000
Magnolia Petroleum Co.:				
Opelousas, St. Landry (Opelousas)	23	20	7,933	80,000
Pan American Petroleum Corp. (formerly Stanolind Oil & Gas Co.):				
South Jennings, Jeff Davis (Jennings)	20	15.9	8,000	38,000
Sun Oil Co.:				
Egan, Acadia	20	20	(‡)	(‡)
Sunray Mid-Continent Oil Co.:				
West Tepetate, Jefferson Davis (Elton)	(‡)	9.6	5,700	7,980
South Sarepta, Bossier (Sarepta)	(‡)	18.3	24,500	99,500 (Dist. and gaso.)
Benton, Bossier (Benton)	55	52.9	41,000	94,000 (Dist.)
Northwest Branch, Acadia (Branch)	(‡)	21.6	15,000	67,200 (Dist.)
Texas Co., The:				
Bateman Lake, St. Mary (Berwick)	145	(‡)	¶8,000	¶135,000
Erath, Vermilion (Erath)	220	(‡)	¶138,600	¶533,400
Total	1,100	564.7	482,833	1,539,557

CYCLING-PLANT SURVEY

Mississippi

California Co., The:				
Cranfield, Adams (Natchez)	112	112	23,000	42,000

Oklahoma

Ells, Harry, Inc., Oper. Shell Oil Co. Barco plant):				
Healdton, Carter (Healdton)	3	2.5	4,000	4,000
Gulf Oil Corp.:				
Kiefer, Creek (Kiefer)	17	13.5	170	24,038
Magnolia Petroleum Co.:				
Chitwood, Grady (Rush Springs)	23.9	11.5	18,627	26,045
Redco Corp. (formerly Carter Oil Co.'s plant):				
Seminole, Seminole (Seminole)	(‡)	16.5	70,000	30,000
Shell Oil Co.:				
Elk City, Beckham (Elk City)	224	(‡)	101,000	289,000
Total	267.9	44	193,797	373,083

Texas

American Liberty Oil Co.:				
Blessing, Matagorda†	30		3,360	21,000
Breckenridge Gasoline Co.:				
Hill, Stephens (Eliasville)	8	7.5	6,100	8,500
Rodessa, Cass (Bivins)	30	25	5,000	11,000
Champlin Oil & Refining Co. (formerly The Chicago Corp.):				
Stalton-Agua Dulce, Nueces (Bishop)	160	150	54,600	71,400
Gulf Plains Plant, Nueces (Bishop)	125	125	52,500	73,500
Coastal Plant, Nueces (Bishop)	125	75	49,250	48,300
Distillate Production Corp.:				
North Houston, Harris (Houston)	75	50	30,000	35,000
Francitas Gas Co.:				
Francitas, Jackson (Blessing)	40	20	4,500	15,000
Gasoline Production Corp.:				
Ray Wilcox, Bee	40	25	5,000	15,000
Gilring Oil Co.:				
Aqua Dulce, Nueces (Banquete)†	60		7,000	25,000

CYCLING-PLANT SURVEY (Texas continued)

Humble Oil & Refining Co.:				
Julian, Kenedy (Encino)	8.2	8.1		30,790
Katy, Waller (Katy)	555	536	559,590	455,660
La Gloria Oil & Gas Co.:				
La Gloria, Jim Wells-Brooks (Falfurias)	325	(‡)	180,000	180,000
Lone Star Producing Co.:				
Opelika, Henderson (Murchison)	70	(‡)	20,000	80,000
Carthage, Panola (Carthage)	100	(‡)		100,000
Chapel Hill, Smith (Tyler)	45	(‡)	40,000	90,000
Luling Oil & Gas Co., Oper. Glen Cove Gasoline plant:				
Glen Cove, Coleman	5	5	7,000	3,000
Magnolia Petroleum Corp.:				
Seeligson, Jim Wells (Premont)	206	144.7	72,814	80,743
Midland Gasoline Corp.:				
Conroe, Montgomery (Conroe)	40	40	36,500	35,000
Pan American Petroleum Corp.:				
Burnell-North Pettus, Karnes-Bee-Goliad (Pettus)	166	178	119,000	168,000
Old Ocean, Brazoria (Sweeny)	350	323	194,000	195,000
Plomo Co., The:				
Brayton, Nueces (Robstown)	60	53	19,301	37,943
Plymouth Oil Co.:				
Plymouth, San Patricio (Sinton)†	75		13,700	10,800
Redco Corp.:				
Kamay, Wichita (Mankins)	(‡)	2	5,000	10,000
Shell Oil Co.:				
Sheridan, Colorado (Sheridan)	108	(‡)	64,400	117,000
South-Tex Corp.:				
Agua Dulce (Robstown)†	60		18,500	20,000
Tidewater Oil Co.:				
Long Lake, Anderson (Palestine)	40	28	5,400	5,800
Trinity Gas Corp.:				
Sejita, Duval (Hebronville)†			15,000	25,000
Total	2,906.2	1,795.3	1,587,515	1,968,436

West Virginia

Owens, Libbey-Owens Gas Dept.:				
Kanawha (Charleston)	25	16	6,000	5,000

Who's Building, Where, Target Date for Completion, and Capacity

A

Ajax Petroleums, Ltd. will complete in 1957 a 20 M.M.c.f.d. plant at Morinville, Alta.

Anchor Gasoline Corp. is building a 25 M.M.c.f.d. plant at East Krotz Springs, La. It will later be expanded to 40 M.M.c.f.d. Marsh Co. of Tulsa is mechanical consultant. Processing is by Charlie Berry of Tulsa. Completion is scheduled for October 1957.

Atlantic Refining Co. will build an absorption-type plant in Crane County, Texas. Delta Engineering Corp. of Houston has the contract and expects to complete the job by October 1957.

B

Barnhart Hydrocarbon Corp. will have increased capacity at its plant near Big Lake, Tex., by 6 M.M.c.f.d. by March 15, 1957. Fish Engineers Corp. is the contractor.

Brazos River Gas Co. plans to expand capacity of its plant at Mineral Wells, Tex., to 30 M.M.c.f.d. by March 1958.

British American Oil Co., Ltd., plans to expand capacity of its Pincher Creek, Alta., plant by 180 M.M.c.f.d.

C

Cabot Carbon Co. will build a $1,000,000, 6 M.M.c.f.d. plant in Lea County, near Lovington, N. M.

NEW CONSTRUCTION SURVEY

Cities Service Oil Co. is building a 50-M.M.c.f.d. plant near Odessa, Tex. Delta Engineering Corp. of Houston is contractor. Completion is set for July 1957.

Continental Oil Co. is building a plant at Short Junction, Cleveland County, Oklahoma. Tuloma Builders of Tulsa is contractor. Completion is scheduled for June 1957.

E

El Paso Natural Gas Co. has under construction a $3,800,000, 165-M.M.c.f.d. plant near Bloomfield, N. M. Stearns-Roger of Denver has contract. Completion is scheduled for January 1, 1958.

A 24.7-M.M.c.f.d.-plant near Sweetwater, Tex., will have been completed by April 15, 1957. Westlake Gasoline Corp. will operate the plant.

G

Ginther, Warren & Ginther will build a plant south of Fort Morgan, Colo. Exact site has not yet been selected.

Gulf Natural Gas will complete spring 1957, a 20-M.M.c.f.d. plant in Caddo Parish, Louisiana. Delta Engineering Corp. has the contract.

Gulf Oil Corp. will expand its Waddell plant near Crane, Tex., by 60 M.M.c.f.d. in 1958 at a cost of $8,000,000. Fluor Corp., Ltd., is the contractor.

H

Honolulu Oil Co. will have completed in March 1957, a 20-M.M.c.f.d. plant at Prentice field in Yoakum County, near Brownfield, Tex. Delta Engineering Corp. is the contractor.

I

Inglewood Gasoline Co. will have completed expansion of gas capacity to 10 M.M.c.f.d. at Potrero in Los Angeles County, by March 1, 1957. Guy T. Martin & Co. of Gardena, Calif., is the contractor. Cost is $350,000.

K

Kentucky West Virginia Gas Co. is building a 50-M.M.c.f.d. plant at Maytown, Floyd County, Kentucky. J. H. Jimison & Son of Huntington, W. Va., has the contract. Completion date is indefinite.

L

La Gloria Oil & Gas Co. is expanding capacity at its Falfurias, Tex., plant. Hudson Engineering Corp. of Houston is the contractor. Completion is set for January 1, 1958.

M

Magnolia Petroleum Co. will have completed a plant near Attica, Kans., in February 1957. Dresser Engineering Corp. is contractor.

Maljamar Co-op. Repressuring Agreement is building a $200,000, 2.3-M.M.c.f.d. plant near Artesia, N. M. Completion is set for July 1, 1957.

N

New Drilling Co. has under construction a 6-M.M.c.f.d. plant at Roggen, Colo.

O

Ohio Oil Co. has under construction a 10 M.M.c.f.d. plant near Orange, Tex. O. L. Olsen Construction Co. of Houston, has the contract. Completion is scheduled for November 1, 1957.

P

Permian Basin Pipeline Co. is expanding its Lea County, New Mexico, (near Hobbs) plant by 50 M.M.c.f.d. Dresser Engineers of Tulsa has the contract. Completion is set for May 1, 1957.

R

Reef Fields Gasoline Corp. is expanding its plant near Big Spring, Tex., by 65 M.M.c.f.d. Delta Engineering Corp. is the contractor. Completion is set for December 1957.

Russell Engineering Corp. of Houston will build and operate a plant in Vallery field east of Fort Morgan, Colo. Capacity will be 2.5 M.M.c.f.d.

S

Sinclair Oil & Gas Co. is expanding capacity at its Gas Products Plant 27 near Sweetwater, Tex., to 9 M.M.c.f.d.

Sioux Oil Co. is building a $100,000 natural-gasoline plant at Newcastle, Wyo. Capacity will be 4 M.M.c.f.d.

Sohio Petroleum Co. is increasing capacity at its Eola, Garvin County, Oklahoma, plant by 3.5 M.M.c.f.d. O. L. Olsen Co. of Houston is the contractor. Cost is $1,790,000, and completion is set for July 15,1957.

Southern Union Gas Co. is building a 10 M.M.c.f.d. plant at Dogie Canyon field, near Farmington, N. M. Completion is set for August 1957.

Standard Oil Co. of Texas is adding L.P.G. production facilities at its Sherman, Tex., plant at a cost of $546,000. Estimated completion date is September 1, 1957.

Sunray Mid-Continent Oil Co. will have completed by April 1, 1957, a 17.5-M.M.c.f.d. plant near Carney in Lincoln County, Oklahoma. Tuloma Builders of Tulsa is the contractor.

T

Tennessee Gas Transmission Co. will build a 10-M.M.c.f.d. absorption-type plant near Lovington, N. M. It will produce about 43,000 gal. of propane, butanes, and natural gasoline per day. Completion is scheduled for late 1957 or early 1958.

U

Union Oil & Gas Corp. and **Texas Gas Exploration Corp.** will complete in September 1957, a 300-M.M.c.f.d. plant at Eunice, La. Fluor Corp., Ltd., has the contract.

Union Oil Co. of California will have completed a $60,000 1-M.M.c.f.d. expansion at its Grimes Canyon plant near Santa Paula, Calif., and a $60,000 1-M.M.c.f.d. expansion at its West Mountain plant, also near Santa Paula, by April 1, 1957.

W

Westcoast Transmission Co., Ltd., is building a 300-M.M.c.f.d. plant at Taylor Flats, B. C., to be operated by Pacific Petroleums, Ltd. Stearns-Roger Engineering Co., Ltd., of Calgary, and Marwell Construction Co. of Vancouver are contractors. Completion is scheduled for November 1, 1957.

Don't Waste That Power

. . . Put it to work

There are three sources of normally wasted power in a natural-gasoline plant. These are exhaust steam above atmospheric pressure, expanding gas, and rich absorption oil flowing from a high pressure to a lower pressure. Machinery at economical costs is readily available to utilize all this normally wasted power.

by Homer C. Givens

ALL of us operating a natural-gasoline plant see large amounts of wasted power that we would like to put to useful work. The first source of power that is normally wasted in a natural-gasoline plant is the reduction in pressure of flowing natural gas. This power, which is easily converted to useful work, has not been taken advantage of as it should. Any machine manufactured to be powered by steam will work just as well when expanding gas is used.

We recently asked a steam-turbine manufacturing company to give us a quotation on a turbine to be driven by expanding gas. The data we furnished them were as follows:

Inlet gas pressure, 300 psig.
Inlet temperature, 170° F.
Horsepower required, 200.
Exhaust pressure, 50 psig.
Specific gravity, 0.6°.

The company quoted a price of $5,910 for a 4,500 r.p.m. turbine and a gas rate of 50.5 lb. per hp.-hr. The rate in more familiar terms would be 1,101 std. cu. ft. of gas per horsepower-hour. Thus the 200-hp. turbine would require 5.284 million standard cubic feet of gas per 24-hour day.

Verbally we were told that raising the inlet gas temperature to 200° F. would lower the rate to 49 lb. of gas per hp.-hr. and if we could use one 400-hp. turbine instead of two 200-hp. machines the rate, with inlet gas at 200° F. temperature, would be 45.5 lb. per hour. With a 400-hp. turbine and 200° F. inlet gas we would require 9.47 million standard cubic feet per day.

Author is plant superintendent, La Gloria Oil & Gas Co., at Falfurrias, Tex. Paper presented at Thirty-sixth Annual N.G.A.A. meeting at Houston, April 24-26, 1957.

Possible saving . . . Twelve years ago we installed a gas-engine-driven electric-generating plant consisting of three gas engines, each driving a 375-kva. alternator. In 1948 we installed a fourth unit identical to the other three. Recently we figured what our electric cost has been over the 12-year period. This figure included the original investment of everything inside the electric generating house; operating expense, using 8 cents per M.c.f for fuel gas; and all maintenance costs. The result was 0.38 cent per kw.-hr. We then estimated our electric cost if we had installed two gas-engine-driven units originally and one turbine-driven unit using part of the 12 M.M.c.f. of fuel gas we were reducing in pressure from 300 to 50 psig. For maintenance-cost estimate we used figures we had on a large steam turbine installed at the same time as the three electric-generating units. This estimate gave 0.2 cent per kw.-hr. Total saving for the 12-year period would have been in excess of $150,000.

So far we have been discussing only turbines but expanding gas also is excellent for powering any reciprocating machine built for steam. However, the efficiency is not as good, or in other words, cubic feet of gas per horsepower-hour is greater in a reciprocating machine than in a turbine.

Rich Absorption Oil

The second source of power normally wasted is rich absorption oil flowing from a high-pressure absorber or a high-pressure flash tank to a flash tank at a lower pressure. In a large plant, with 100 M.M.c.f. per day capacity or more, this power is a very substantial figure.

There are two general classes of machines manufactured to utilize this normally wasted power. These are centrifugal and positive-displacement units. We will consider the centrifugal unit first.

Centrifugal machine . . . This is usually termed a hydraulic turbine, and is merely a centrifugal pump with oil entering the normal discharge nozzle and exiting from the normal suction nozzle. However, do not expect to use some spare centrifugal pump you may have as a hydraulic turbine. The impeller shaft must be modified by having left-hand threads where normally there are right-hand threads and vice versa. Also to obtain maximum efficiency the volutes must be modified.

My company has not operated a hydraulic turbine but we are preparing to install two 150-hp. units in the near future. Warren Petroleum Corp. and Arcadia Corp. each have one operating and are quite pleased with the results they are obtaining.

The unit Warren is operating drives a centrifugal pump directly connected. The one Arcadia is operating drives a septiplex piston pump through a gear-box speed reducer.

The efficiency of the entire Arcadia unit is 55.8 per cent. That is considering the power to the hydraulic turbine and the power required to move the oil pump by the septiplex pump. These multicylinder piston pumps usually have an efficiency of 90 per cent; therefore, the efficiency of the hydraulic turbine and gear-box speed reducer is 62 per cent.

Flashing . . . Theoretically a hydraulic turbine should have the same efficiency as it would operating as a pump, and actually this is true if the fluid in both cases is not flashing. However, a hydraulic turbine operating on rich absorption oil has a higher efficiency than it would as a pump because the governor valve on the inlet oil allows flashing to take place inside the impeller which gives

TABLE 1—COMPARATIVE COSTS OF HYDRAULIC TURBINES, STEAM TURBINES, ELECTRIC MOTORS AND GAS ENGINES

Unit—	Horsepower	Cost per horsepower— Purchase	Installed	Appurtenance
Hydraulic	100	*$134.75	$164.75	$164.75
Turbine	250	70.00	90.00	90.00
Electric	100	58.50	89.50	189.50
Motor	250	35.50	61.00	161.00
Steam	100	36.00	76.00	226.00
Turbine	250	30.00	66.00	216.00
Gas	100	75.50	90.00	90.00
Engine	250	115.00	145.00	145.00

*Average cost of several makes and types and includes gear-box speed reducer.

added thrust because of the flash vapors expanding. This increase has been reported to be as much as 4 percentage points higher.

Costs . . . Table 1 gives the various costs per horsepower comparison of hydraulic turbines, steam turbines, electric motors, and gas engines for 100 and 250-b.hp. machines. "Appurtenances" means the boilers or electric generating plant in their proportionate part. The operating cost of the hydraulic turbine is less than the other three. The maintenance cost of the hydraulic turbine, steam turbine, and the electric motor will be almost identical. However, maintenance on the gas engine is much higher.

The positive-displacement units, usually termed hydraulic motors, are of three types. These three types may be classed as reciprocating piston, meshing helical screws, and rotating drum with vanes and timed rotating valves. The reciprocating piston hydraulic motors are primarily used as meters and to operate intermittently, doing such small jobs as opening and closing gate valves.

The meshing helical-screw type is a high-speed machine, 3,200 to 3,600 r.p.m. being optimum. The ones that have given the best service have the fluid entering each end and discharging from the middle. (Fig. 1).

La Gloria has had one of this type driving a centrifugal pump continuously since July 1, 1955. It has never stopped because of anything being wrong with it. For a period of 6 months a bypass was on the centrifugal pump so it could move its maximum volume, thus requiring the hydraulic motor to develop its maximum horsepower.

Performance . . . During this 6-month period, records were kept of the r.p.m. pressure in and out of the motor, volume of oil to the motor, pump suction and discharge pressures, and volume pumped. The overall efficiency of the motor-pump unit averaged 41 per cent. The pump curves gave an efficiency of 60 per cent; therefore, the motor was 68.4 per cent efficient. However, this is not a true value of efficiency for the motor, as a ¼-in. copper tubing bled oil from the mechanical seal cage to the discharge of the motor. It is believed some 30 to 35 g.p.m. were bypassing the motor through this line.

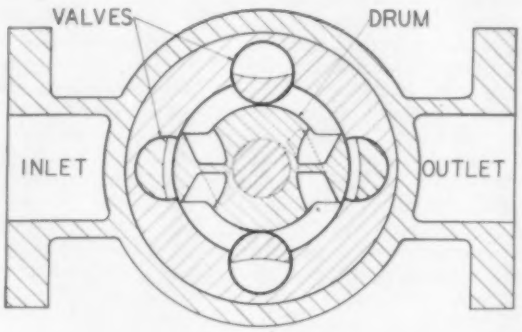
If we consider 35 g.p.m. were bypassing the motor, the efficiency would be raised to 80 per cent. We do not believe the bypass line is necessary but there is no way of shutting it off except by stopping the motor. This particular motor was governed with the inlet oil valve the first 2 weeks and due to flashing effect in the screws showed several percentage points higher efficiency.

Governing . . . Because of the flashing, it was decided to govern with the outlet valve, not knowing whether vapors would increase the wear on the screws or not. After 6 months operation the manufacturer completely dismantled the motor and measured all parts for wear. No wear could be detected. My personal opinion is that if a few more horsepower were needed from this unit, governing with upstream valve would not hurt it.

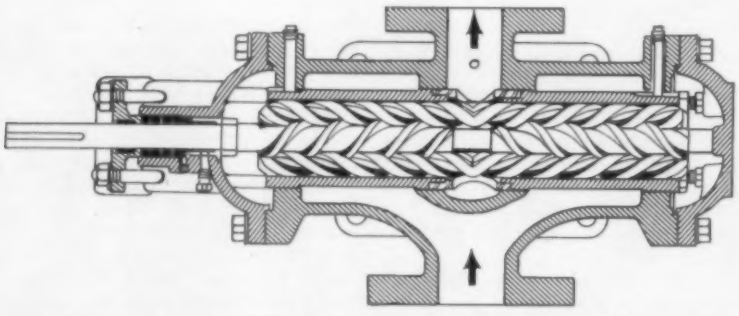
Drum fans . . . The rotating drum with vanes and timed rotating valves positive-displacement hydraulic motor (Fig. 2) in our experience is very good when operating at 300 to 800 r.p.m. It is ideal to drive fans on fan-cooled equipment. If the fan is lightweight it can be mounted directly to the motor shaft. If the fan is too heavy to mount directly on the motor, the motor may be mounted vertically with shaft extension either up or down and V-belts, running in a horizontal plane, used to drive the fan.

These motors are very efficient, having been checked when driving a centrifugal water pump as high as 92 per cent. Two units we have driving fans on still overhead condensers have an efficiency of 85 per cent from oil in to air away from fan.

B. J. Thompson, of Warren Petro-



ANOTHER type of hydraulic motor. This positive - displacement machine consists of rotating drum with vanes and timed rotating valves. Fig. 2.



MESHING helical-screw-type hydraulic motor. This is a high-speed machine, 3,200 to 3,600 r.p.m. being optimim. Fig. 1.

leum Corp., gave me data on one of these units which was directly connected to a centrifugal pump feeding a deethanizer. It is driving the pump at 3,400 r.p.m. and had been doing an excellent job for 6 months at the time of reporting. Unfortunately he did not have the volume of oil required to operate it so the efficiency could not be determined.

Both of the latter hydraulic motors compare favorably in purchase cost and installed cost with a high-efficiency steam turbine. They are higher than electric motors in the 15 to 50-hp. sizes but closely approach electric motors in the 75 and 100-hp. units. However, the cost of obtaining steam or electricity must be taken into account when deciding which driver to use.

Governors . . . Good low-cost governors for hydraulic machines have not been developed yet. Therefore, at present most are operated by hand adjusting the proper valve, or a demand pressure or flow controller. Hydraulic units are especially suited for controlling by demand controllers.

Exhaust Steam

Another source of normally wasted power in a large plant is exhaust steam if most pumps are run by steam turbines. It is not economical to run a large number of small steam turbines full condensing; therefore, most of them exhaust at 10 psig. This steam can be collected and used to drive a large-horsepower low-pressure turbine. We are planning on using 80,000 lb. per hour of such steam to drive two 1,425-hp. turbines in the near future.

This steam was with us 12 years ago when we added the electric-generating plant. It hurts me to think of the money we would have saved if we had used it to generate electricity and the expanding fuel gas to power the circulating water pump and fans on the cooling tower for the surface condenser. Probably it would have been in the neighborhood of a quarter-million-dollar saving and several times that in worry for the entire operating force.

In conclusion, anyone contemplating building a new plant or enlarging an existing one should examine every source of power that normally is going to waste.

Acknowledgment

I wish to thank Warren Petroleum Corp., Arcadia Corp., Rockwell Manufacturing Co., Ingersoll-Rand Co., De Laval Steam Turbine Co., Worthington Pump & Machinery Corp., and Pacific Pumps, Inc., for aid in preparing for this paper.

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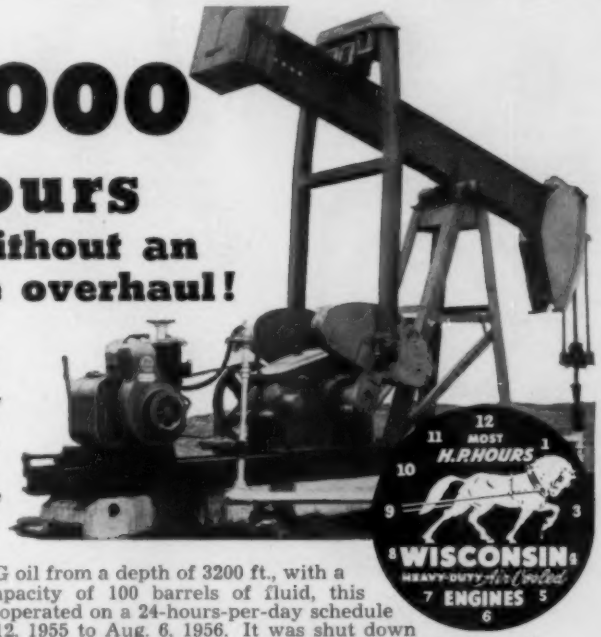

● This Model TFPD Wisconsin Air-Cooled Oil Well Pumping Engine was operated practically continuously for a total of 11,000 hours (the equivalent of approx. 75,240 hp. hours, operating at 1800 rpm., 60% loaded) . . . verified by the sworn statement of the supervising oil field foreman.

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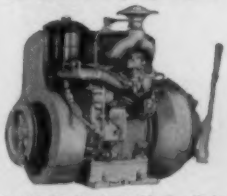

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How to calculate

Lean-Oil Vaporization Loss

. . . in absorber discharge gas

by C. J. Walters

ABSORPTION - PLANT operators have long recognized that some amount of lean oil vaporizes in absorbers and is carried off in the discharge gas. As long as well-stripped, heavy oils were used, the loss was generally considered insignificant. However, with the trend toward lighter oils, there has been a growing concern over vaporization loss. Under certain conditions as much as 30 gal. of oil per M.M.c.f. of gas can be carried as vapor into sales or injection-gas lines. Where dehydrators operate on the lines some oil may be recovered, but in general the oil is a loss to the absorption plant.

To make economic evaluations or to take corrective steps, the actual loss must first be determined. Measurement by lean-oil stock balance is not feasible. Variations are too great in the separation of gasoline from lean oil in the stripper. The discharge gas cannot be readily analyzed for trace absorption-oil fractions because present analytical[2] methods are too complex for plant control use.

Previous work . . . The best previous solution to the problem appears to be a calculation method based on lean-oil vapor pressure (l.o.v.p.) at 100° F. Johns[4] describes the method in his paper on lean-oil testing. The first step consists of an l.o.v.p. measurement according to a method given by the California Natural Gasoline Association.[1] In the second step, a factor is read from a correlation as a function of absorber pressure and top-tray temperature. The gallons of isopentane and heavier lost in each 1,000 cu. ft. of gas (gal./M.c.f.) is calculated by simply multiplying the measured l.o.v.p. by the correlation factor.

The limiting assumption in this calculation method is that a single factor will correlate the behavior of lean oil at 100° F. and approximately atmospheric pressure with its behavior at absorber operating conditions. Such an assumption is satisfactory only if the lean-oil volatility is due primarily to a narrow cut of unstripped gasoline. If, however, the lean oil itself is volatile enough to account for a portion of the vaporization loss, the method cannot be expected to give satisfactory answers.

Theoretically a separate correlation, such as one using vapor-liquid equilibrium ratios, for each of the many components present in the lean oil would be necessary for accurate calculation. Also the concentration of each of these components in the lean oil would be required. Such an approach is not feasible because neither the correlations nor the analytical methods are presently available.

A New Calculation Method

A calculation method is presented here that compromises the approxi-

Field Processing

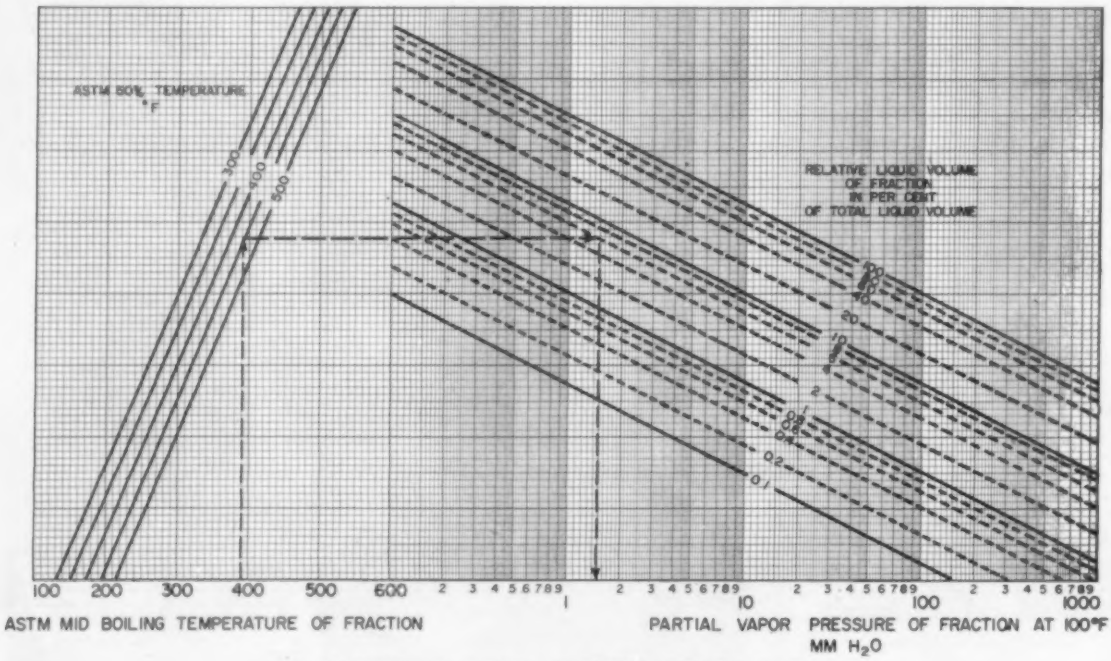

Fig. 1—Partial vapor pressure of A.S.T.M. distillation fractions.

Griscom-Russell is now entering the last decade of a

Century of Progress

Looking Backward

Ninety years ago in New York Harbor a modest ship chandlery was established to service the needs of seagoing vessels as they plied into port for fitting and repairs. The enterprise developed fast until it was manufacturing small equipment and later a line of coil tube heat exchangers, which due to their long, efficient and trouble free service, created the reputation for dependable products which The Griscom-Russell Company still enjoys. There followed equally reliable lines of Marine Distilling Plants, Tubular Exchangers, Bentube Evaporators, Feedwater Heaters and Extended Surface Heat Exchangers for land and sea service. Through the years the chemical, petroleum, utility and marine industries have recognized the increasing need for heat exchange equipment and G-R has met these needs with progressive designs and manufacturing facilities. The requirements for increasingly higher temperatures and pressures have been met by G-R's 200 engineers, designers, draftsmen and by a well qualified manufacturing personnel. Today we serve a long line of established customers in all major industries.

Looking Forward

We are now on the threshold of the atomic age, a challenge to the engineering, designing and marufacturing ingenuity of our people. Nuclear power will necessarily supplant present day power supply systems as our resources of oil and coal are depleted. G-R has been engaged in research resulting in the production of heat transfer equipment for this field. Such equipment must operate under service conditions involving fluids at temperatures and pressures in the high ranges. Severe service conditions are also met with in the petro-chemical field, an industry which is still in its infancy. In the manufacture of heat transfer equipment of this kind the most exacting manufacturing techniques must be employed. G-R has the necessary facilities including X-ray and stress relieving, ultrasonic and dye penetrant testing, welding equipment and techniques requiring specially qualified and registered operators. The indications are that the heat transfer equipment of the future will demand that these manufacturing practices become routine procedures. As in the past, G-R is prepared. To those who have new problems involving heat transfer between any fluid mediums including liquid metals, G-R engineers are able to advise. It is probable that they have already met similar situations.

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mate with the exact approach. Common analytical methods are retained and the calculations are set up for rapid and convenient use.

Assumptions . . . Three basic assumptions are made in the development of the new method. First it is assumed that an Engler or A.S.T.M. distillation[1] can be used to establish the approximate composition of lean oil, secondly, that the contribution of lean-oil fractions to l.o.v.p. can be estimated, and thirdly, that equilibrium relationships can be developed from data presently available[3,6] for predicting the behavior of lean-oil fractions at absorber conditions.

While this approach of breaking the lean oil into fractions will not have the accuracy that a component-by-component method would give, it is nevertheless an improvement over treating the lean oil as a single component.

Approximate relationship . . . The approximations necessary to arrive at the final relationships are as follows and illustrate why the method is restricted in its application:

1. The ratio of molecular weight to the specific gravity of an absorption-oil fraction is assumed proportional to the midboiling temperature taken from a true-boiling-point (t.b.p.) curve, i.e.:

$$\frac{\text{mol. wt.}}{\text{sp. gr.}} = \text{(constant) t.b.p. mid-boiling temp.}$$

The average deviation from this relationship for hydrocarbon fractions[5] boiling between 200° and 500° F. was found to be approximately 10 per cent. However, this error applies only to dividing the absorption oil into mole fractions and is estimated to affect the final correlation by only about 1 per cent.

2. For any fraction, the t.b.p. midboiling temperature is assumed to be a function of the A.S.T.M. midboiling temperature and the A.S.T.M. 50 per cent temperature of the total oil. On the basis of correlations of A.S.T.M. and t.b.p. distillations, this relationship was found to be approximately:

t.b.p. midboiling temperature = 1.6 (A.S.T.M. midboiling temperature) − 0.57 (A.S.T.M. 50 per cent temperature).

The average error will generally be less than 5° F. for absorption oils boiling between 200° and 500° F. and will tend to compensate for the error discussed in the preceding paragraph.

3. Raoult's law is assumed to apply for absorption-oil fractions at 100° F. and 1 atm., and l.o.v.p. is assumed to approximate the true vapor pressure of lean oil.

THE AUTHOR

C. J. Walters has been with California Research Corp. since he received his doctorate in chemical engineering at Purdue University in 1951. He is project leader of the natural - gasoline research group at the company's La Habra laboratory and is also doing work on secondary-recovery methods. He is a member of both the technical committee of the California Natural Gasoline Association and Subcommittee F on K-values of the Natural Gasoline Association of America.

4. Lean oil is assumed to come to equilibrium with pure methane on the absorber top theoretical tray. This approximation is used to estimate the concentration of lean oil at the point where vaporization loss occurs. The average error resulting from the presence of ethane and propane will be negligible at low pressures (100 psia.) and not greater than 5 per cent at high pressures (1,500 psia.) for most absorbers processing natural gas. Such an error will cause a higher indicated vaporization loss than would actually occur.

5. Vaporization characteristics of the absorption-oil fractions at a given temperature and pressure are assumed to have a straight-line relationship when plotted against t.b.p. midboiling temperature. This is an empirical correlation that appears to be as ac-

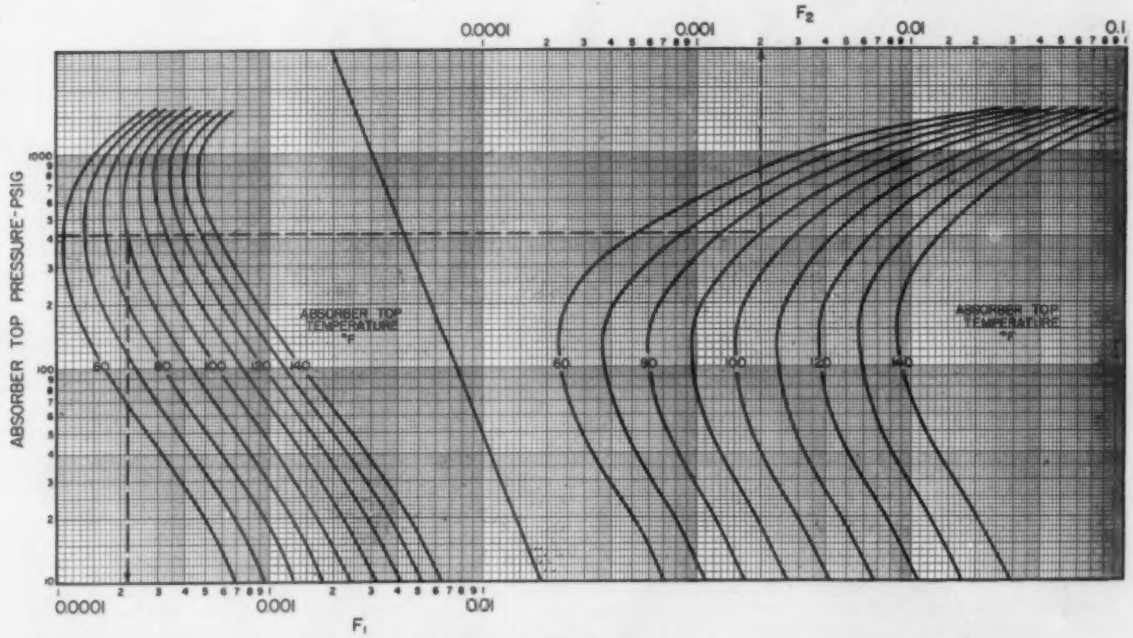

Fig. 2—Factors for absorber top-tray conditions.

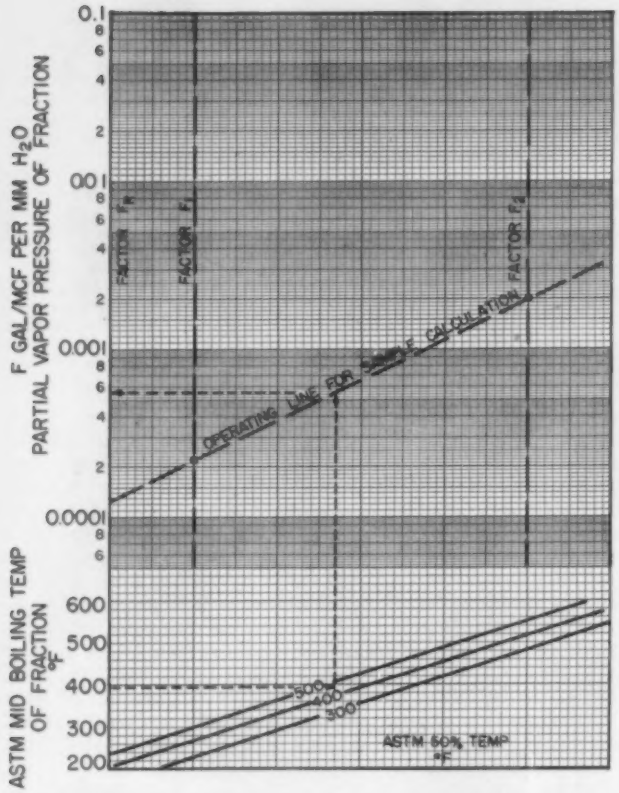
F GAL/MCF PER MM H_2O
PARTIAL VAPOR PRESSURE OF FRACTION
FACTOR F_R
FACTOR F_1
FACTOR F_2
OPERATING LINE FOR SAMPLE CALCULATION
ASTM MID BOILING TEMP OF FRACTION °F
ASTM 50% TEMP °F

Fig. 3—Operating line for absorber top tray conditions.

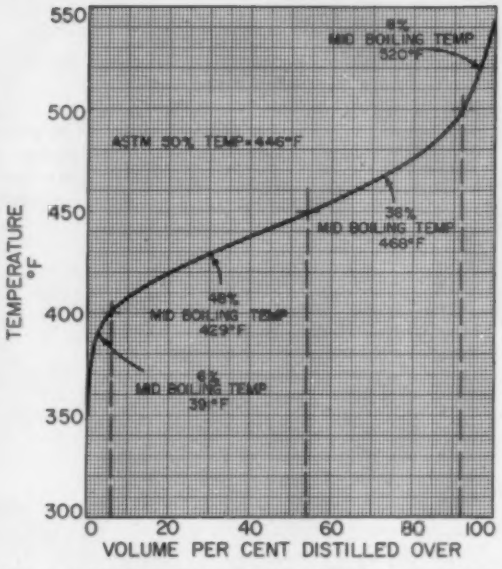
TEMPERATURE °F
ASTM 50% TEMP = 446°F
8% MID BOILING TEMP 520°F
36% MID BOILING TEMP 468°F
48% MID BOILING TEMP 429°F
6% MID BOILING TEMP 391°F
VOLUME PER CENT DISTILLED OVER

Fig. 4—A.S.T.M. distillation of absorption oil in sample calculation.

curate as the equilibria data for absorption-oil fractions.

6. Unstripped gasoline in lean oil is assumed to follow the equilibrium behavior of normal pentane.

On the basis of these approximations, the relationships shown in Figs. 1, 2, and 3 were developed. Fig. 1 relates the relative amount and A.S.T.M. distillation characteristics of each lean-oil fraction to its partial vapor pressure at 100° F. Fig. 2 gives two equilibrium parameters (F_1 and F_2) as functions of absorber-top-theoretical-tray conditions. These two parameters establish an "operating" line on Fig. 3 for loss of lean-oil fractions at given absorber conditions as a function of their A.S.T.M. distillation characteristics. The lower plot in Fig. 3 is based on the relationship between A.S.T.M. distillation characteristics and t.b.p. midboiling temperatures. F_1 and F_2 correspond to fractions with t.b.p. midboiling temperatures of 200° and 600° F., respectively.

Calculation Procedure

The procedure for using the charts consists of first dividing the lean-oil A.S.T.M. distillation curve into an arbitrary number of liquid fractions. For example, the fractions distilled off between certain temperature levels may be used, such as between 350° and 400° F., 400° and 450° F., and so on. These fractions are identified by their A.S.T.M. midboiling temperatures and the A.S.T.M. 50 per cent temperature for the total lean oil. From Fig. 1 the partial vapor pressure of each fraction is determined. These partial pressures are summed and subtracted from the measured l.o.v.p. to get a "residual" l.o.v.p. In effect, the residual l.o.v.p. is the vapor-pressure contribution of trace light components not detected in the A.S.T.M. distillation.

Vapor-liquid equilibria . . . The next step involves establishing vapor-liquid equilibria characteristics for the fractions at absorber-top-tray conditions. From Fig. 2, two parameters F_1 and F_2 are read at absorber-top-theoretical-tray temperature and pressure. These factors are then plotted on the F_1 and F_2 axes of Fig. 3. A straight line through these points is the operating line. Fig. 3 now gives the vaporization characteristic of each fraction as a factor, F. The gal./M.c.f. vaporization loss of each fraction is the product of F and the partial vapor pressure of that fraction. The factor F_R for the residual l.o.v.p. is the value of F at the intersection of the operating line and the F axis. The total loss of lean oil is the sum of the losses for the individual fractions.

Sample calculation—Use of the method is illustrated by the following sample calculation:

Basis:

A.S.T.M. distillation of lean oil in Fig. 4.
L.o.v.p. = 65 mm. H_2O.
Absorber-top-tray temperature = 90° F.
Absorber-top-tray pressure = 416 psig.

Step 1. Divide the A.S.T.M. distillation curve of Fig. 4 into arbitrary

TABLE 1—SAMPLE CALCULATION

Fraction—	Per cent (liquid)	Partial vapor pressure (mm. H_2O)	F	Vaporization loss (gal./M.c.f.)
391/446*	6	1.5	0.00056	0.0009
429/446	48	2.1	0.00076	0.0016
468/446	38	0.2	0.00107	0.0002
520/446	8	0	0.00180	0
Residual l.o.v.p.	..	61.2	0.000126	0.0077
		65.0		0.0104

*A.S.T.M. midboiling temperature of fraction/A.S.T.M. 50 per cent temperature of total lean oil.

TABLE 2—COMPARISON OF CALCULATED LOSSES WITH EXPERIMENTAL DATA

Absorber	Pressure (psia.)	Temperature (°F.)	Mol. wt.	L.o.v.p. (mm. H_2O)	Absorption oil loss (gal./M.c.f. of C_5+) Experimental	Correlation
A	56	59	150	112	0.028	0.033
B	431	90	178	65	0.009	0.010
C	1,634	104	177	*33	0.023	0.030
D	1,515	94	175	*33	0.032	0.025

*Uncertain l.o.v.p. data.

fractions, as indicated, and tabulate the per cent of each fraction as shown in Table 1. For illustration, fractions boiling over a 50° F. temperature range were selected.

Step 2. From Fig. 1, determine the partial vapor pressure of each fraction and enter in the tabulation.

Step 3. Sum the partial pressures of the A.S.T.M. distillation fractions and subtract the sum from the measured l.o.v.p. Enter the residual l.o.v.p. in the table.

Step 4. Using absorber-top-tray conditions, read fracture F_1, 0.00022, and F_2, 0.00200, from Fig. 2.

Step 5. Plot F_1 and F_2 on the axes indicated in Fig. 3 and draw a straight line through the two points. This is the operating line for the absorber at the given conditions.

Step 6. From Fig. 3 read the factor F for each fraction. F_R for the residual l.o.v.p. is given by the intersection of the operating line with the F axis. Use as many significant figures as can be read from the chart.

Step 7. Multiply the mm. H_2O partial vapor pressure of each fraction by its corresponding factor F and sum the products to get the total gal./M.c.f. loss for the lean oil.

Conclusions . . . Because of the assumptions and approximations involved, application of the method presented here should be limited to lean oils that have less than 150 mm. vapor pressure at 100° F. The A.S.T.M. distillation range should not be over 200° F., and the method should be used only for absorbers processing natural gases of average composition. These arbitrary limitations are imposed because experience and information are lacking for other conditions. A comparison of the method with experimental data is given in Table 2. The experimental losses were measured by the special analytical method described in an earlier paper.[2]

A comparison of the experimental values with the correlation results indicates an average deviation of about 20 per cent. This deviation includes errors that might be in the l.o.v.p. measurement and in the experimental determination of the absorption oil vaporization loss. Final evaluation of the method requires appreciably more checking. However, if the basic assumptions are as accurate as presently believed, then the accuracy of the method should be within the indicated 20 per cent.

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4. Johns, D. B., Proceeding twenty-seventh annual meeting of C.N.G.A., Los Angeles, October 9 to 10, 1952, pp. 35 to 38.
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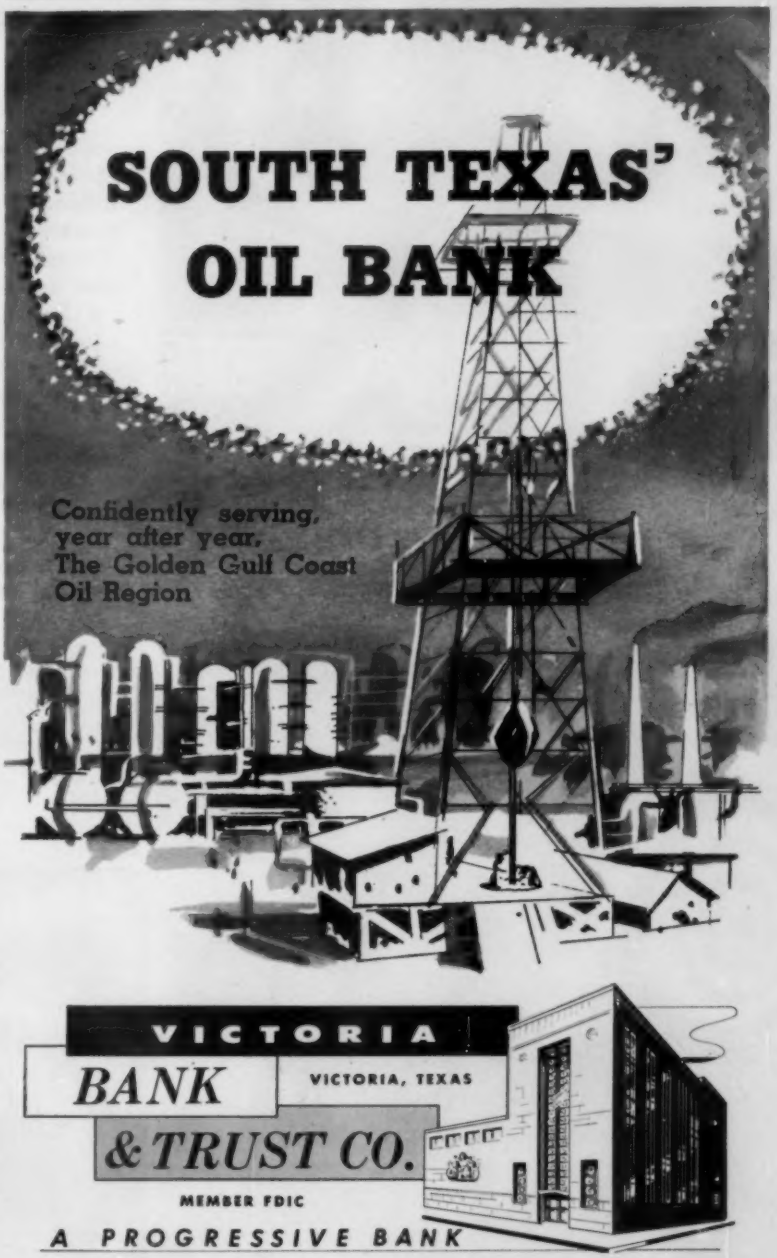

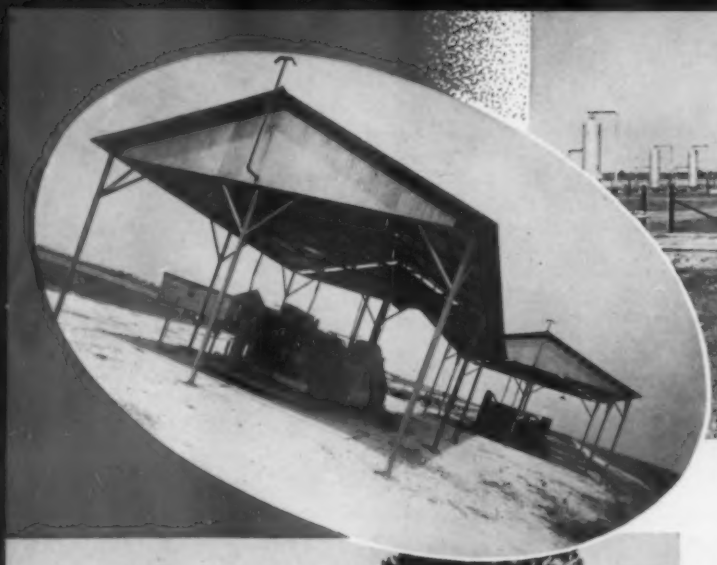

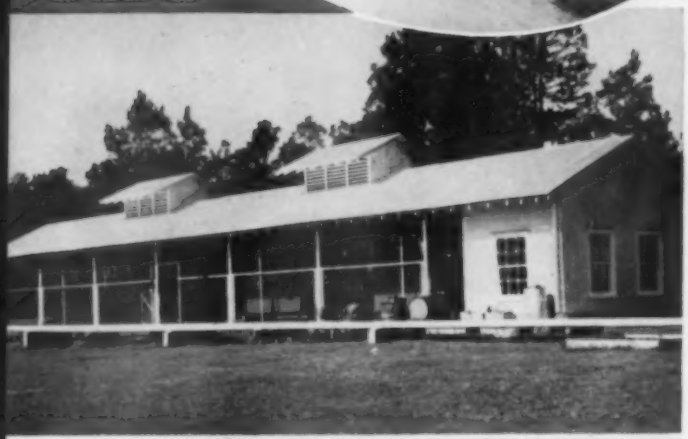

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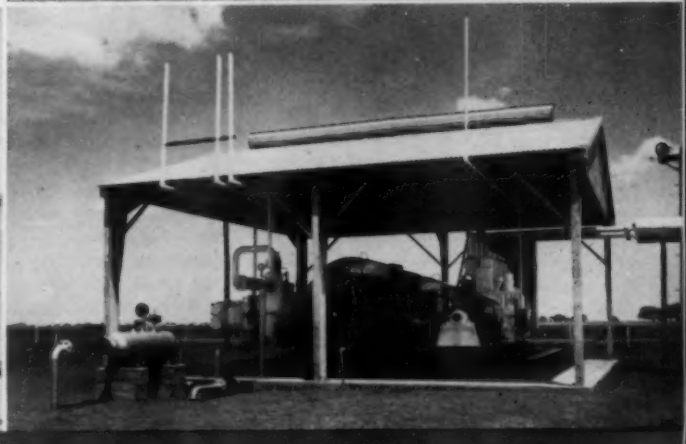

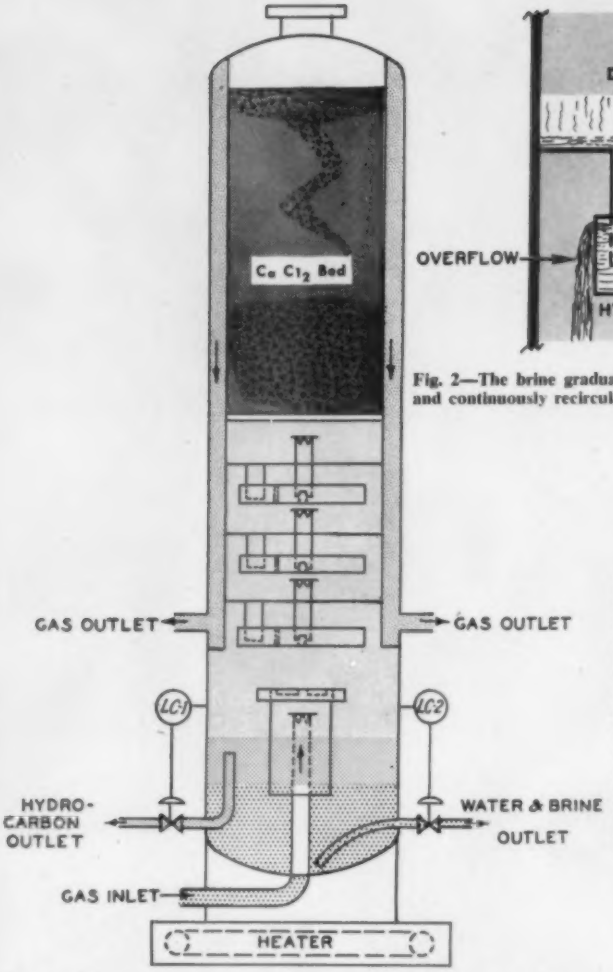

Fig. 1—Calcium chloride units installed by Pacific Northwest Pipeline Corp. have five brine circulating trays.

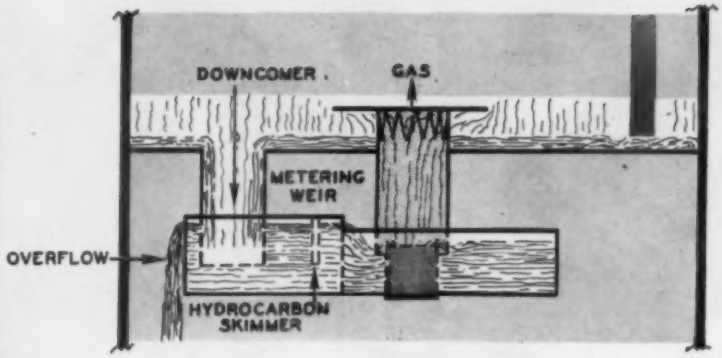

Fig. 2—The brine gradually works its way down through the trays and is automatically and continuously recirculated by the flow of gas up through the trays.

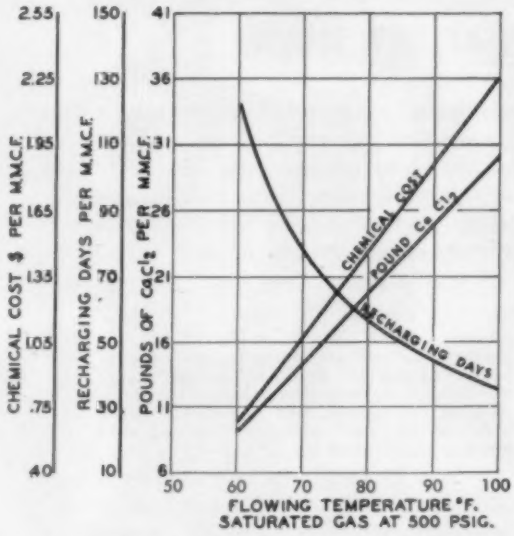

Fig. 3—Recharging days, pounds of chemical required, and chemical cost vs. flowing temperature of gas. To lower chemical consumption it is desired that flowing temperature be maintained at or near hydrate freezing point.

Wellhead Dehydrators in S. J. Basin

by Oliver W. Fowler

Companies operating in the San Juan basin at present have two gas-gathering systems—one that is operated at a pressure of 250 psi. to gather the Pictured Cliffs gas, and another that is utilized to gather Mesaverde and Dakota gas at 500 psi. In many instances, because of the rocky terrain of the San Juan basin, well lines in the gathering system are laid either near, or on, the surface. The lateral and trunk lines are laid with approximately 3 ft. of cover. All the gas produced is fully water saturated. This, coupled with the fact that the average frost line in the basin is 3 ft. and the hydrate freezing point is 53° F. at 500 psi., necessitates wellhead dehydration on the 500-psi. systems to successfully gather and transport the gas to central points for processing and delivery into the main transmission lines.

Author is with Pacific Northwest Pipeline Corp., Farmington, N. M. Paper presented at A.P.I. production meeting, Dallas, under the original title, "Wellhead Dehydration Units, San Juan Basin."

Two principal methods of wellhead dehydration are used in the San Juan basin. One, instituted several years ago, is by absorption of water into glycol. The other is by chemical absorption of the water from the gas by anhydrous calcium chloride pellets, and utilization of the brine thus formed through a series of trays to predehydrate the gas.

Field Processing

Glycol Dehydrators

Glycol units were first installed in the basin in 1950. They were very crude in comparison with the units being used today. No separator or scrubbing element was used, and this proved very unsatisfactory because of

the free water and distillate that many of the Mesaverde wells produce. Inlet scrubbers were added, mounted on skids with the dehydrator, contactor column, glycol pump, and reboiler, becoming a compact package unit. The next improvement occasioned by the below-zero weather experienced during the winter months in the San Juan basin, was the addition of ½-in. pipe coils inside the lower one-third of the separator shell for the circulation of hot glycol to prevent freezing in the separator. These coils also serve the purpose of breaking the heavy viscous emulsions formed in wells producing a very waxy 38°-A.P.I.-specific-gravity oil in certain areas of the basin.

Loss of units . . . Each winter several glycol units are burned, mainly as a result of the failure of the separators. This results in carryover of distillate to the dehydrator contactor column. Then it contaminates the glycol, reaches the reboiler, boils off, and ignites the unit. The addition of drips and safety shutoff valves on the fuel-gas lines to the reboilers has eliminated fires that were caused by the condensation of distillate in the fuel-gas supply lines. The overloading of the glycol unit when placing shut-in wells on the line and the failure of the separator dump valves are the main causes of excessive glycol loss now being experienced.

A new pump is now being tested to use the return glycol from the contactor as a power medium. This will conserve the reservoir gas now being used to furnish energy for the circulation of the glycol through the contactor column. As yet this pump has not been fully proved as a satisfactory method of power, as all wells in the San Juan basin produce a certain amount of fine abrasive sand which could cause extreme wear on any pump that depends on the return glycol for power.

There are now 1,200 packaged, skid-mounted glycol units being operated in the San Juan basin, ranging in capacity from 1 M.M.c.f. of natural gas daily to 50 M.M.c.f.. The average dew-point depression being obtained is in the neighborhood of 60° F. This is very good considering the conditions under which field equipment has to operate in the San Juan basin. The field men attending to these units are handling an average of 50 wells, and the resultant dew-point experienced in the gathering system where the gas is dehydrated by glycol units it plus 20° F.

Calcium Chloride Units

In 1955 an intensive experimental testing program was undertaken to design and build a field dehydration unit using calcium chloride. Brine trays used below the pellet bed were designed and patented by A. J. Hutchinson, of Fish Engineering. Hutchinson had done preliminary experimental work in Carthage field of Texas with these trays.

During the winter of 1955 a dependable and economic calcium chloride wellhead dehydration unit became feasible. In the summer of 1956 calcium chloride dehydration units were installed throughout the Pacific Northwest Pipeline gathering system. Many improvements have been introduced in the units in the very short time that they have been operating; but over-all, we have found it is only necessary to check the units four times each month, at the time the flow charts are being changed.

The calcium chloride unit was enclosed in a building because of the danger of freezing of the brine in the contactor trays and sensitivity of the dumping and regulating equipment to atmospheric conditions. Considerable trouble has been experienced with the

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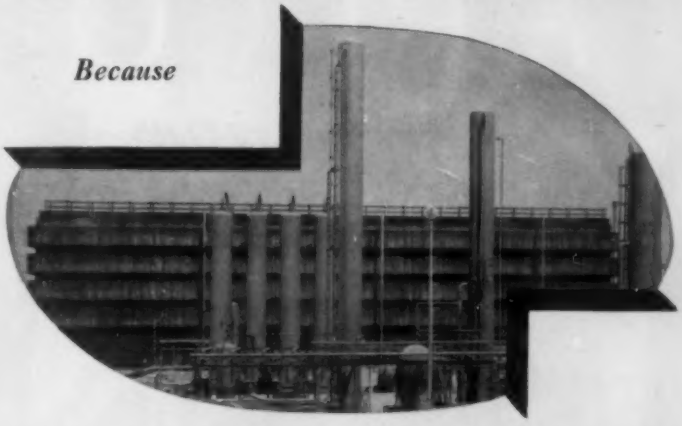

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firing equipment, and this can stand improvement. Well-line freezeups have resulted from the channeling of the calcium chloride bed by the gas flow.

An additional headache experienced with the operation of this unit has been the necessity of recharging it periodically with the calcium chloride pellets. This operation has been expensive because of the long distances that have to be traversed in servicing, and the road conditions in the San Juan basin. During the winter months we have snow and ice, in the spring it is bottomless mud, and during the summer and fall there are flash floods and washouts caused by the high rate of runoff in the many arroyos and washes that are crossed by the road system.

How they work . . . The calcium chloride dehydration units that have been installed on Pacific Northwest's wells to date have five brine circulating trays, and the anhydrous calcium chloride bed has a capacity of four 370-lb. drums. (Fig. 1). Gas enters the bottom, passes through the brine trays, then contacts the bed of calcium chloride. Water from the gas passing through the upper bed of anhydrous calcium chloride forms a concentrated brine of 1.40 specific gravity that drips down into the self-circulating trays continuously. This brine gradually works its way down through the trays and is continuously and automatically recirculated by the flow of the gas up through the trays (Fig. 2).

Specific gravity of the brine at the bottom of the column is approximately 1.15 to 1.20; and, because of the low cost of material, it is considered expendable and dumped into a pit along with any free water produced by the well. The brine is recirculated on each tray as a fine mist when it is picked up by a jet nozzle located in the center of the tray. The rate of circulation is controlled by a series of weirs, baffles, and nozzle sizes in the tray. The size of the weirs and nozzles is determined by the flow rate the unit is designed to handle.

As the 8-ft. calcium chloride bed is used up forming brine, the bed of calcium chloride settles. However, the efficiency of the unit is not affected until the level falls to a depth of 24 in. As an example of the efficiency of the unit, on January 30 this year Pacific Northwest had a well producing at a flow rate of 4.6 M.M.c.f. per day and flowing temperature of 127° F. The resulting dew point was plus 7°, and an inspection of the calcium chloride bed revealed there was 1 bbl. or approximately 2 ft. of calcium chloride left.

This high flowing temperature is common at this flow rate from the Mesaverde wells located in the Colorado portion of the San Juan basin. The resulting dew point varies between a minus 5° and plus 10° regardless of the wellhead flowing temperature.

Cost . . . It is desirable that the flowing temperature be maintained at or near the hydrate freezing point in the separator section of the dehydration unit to lower the consumption of calcium chloride. Inasmuch as the unit consumes calcium chloride in direct weight to water vapor contained in the gas at operating pressures and temperatures, the needed time of recharging can be accurately forecast (Fig. 3).

The ⅜ to ¾-in. calcium chloride pellets that are used for charging the dehydration unit are purchased from Dow Chemical Co., Ludington, Mich., for $90 per ton. The delivery price of this calcium chloride f.o.b. Farmington, N. M., is $133 per ton.

The average dew point maintained in the San Juan basin gathering systems of Pacific Northwest Pipeline Corp. has been plus 5°, or 4 lb. of water per M.M.c.f.

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1 Flood water flows from a well in the Mississippi limestone formation at 1,900 ft. It contains corrosive materials.

2 A line of 2-in. cement-lined pipe is laid in place at a water-flooding project. Ordinary pipe will last only 6 months.

3 Adrian Feltenberger, Forest Oil Corp., checks a meter on an injection well.

4 Water pumped into the injection well (which is being installed in the background) will bring up oil through this pumping unit at Curl Creek field, Nowata, Okla.

Old Cement-Lined Pipe Transports Flood Water

A FEW months ago near Nowata, Okla., workmen of Forest Oil Corp. dug up some cement-lined pipe that had been in the ground for 20 years. They didn't expect the pipe to be of much value because it had been handling salt water containing hydrogen sulfide and other corrosive materials that will eat through ordinary pipe in as little as 6 months.

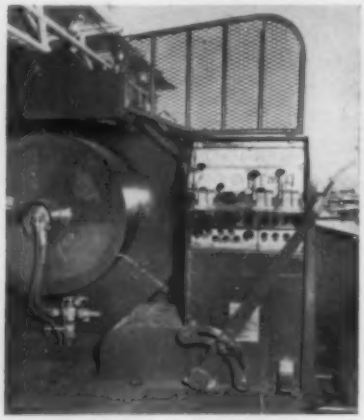
But the workmen were in for a surprise. When the cement-lined pipe was taken from the ground it was in excellent shape. In fact, the pipe was in such good condition that it could be used in Forest Oil's newest project, Flood No. 32. The water flood in which it was first used was Flood No. 1, Forest Oil's first in the area.

Flood water . . . Forest Oil gets the necessary water for flooding from the Mississippi limestone at 1,900 ft. The water is almost black when it comes to the surface. It is first collected in settling ponds, then is treated with chemicals.

From the time it leaves the treating station until it is pumped into the oil sands, the water travels in cement-lined pipe. Size ranges from 1½ to 6 in.

Produced water and oil is transported in cement-lined pipe, also. After separation, the water is returned to the water-flooding system.

CYLINDER made of scrap pipe keeps jerk line off rig floor.



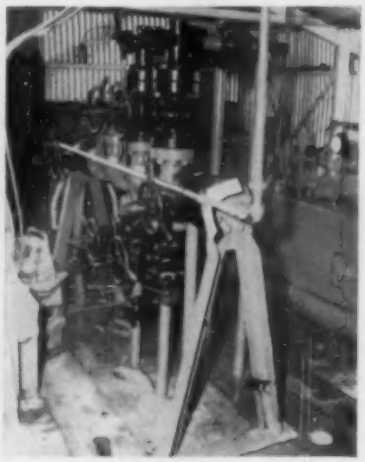
METAL SCREEN protects driller if jerk line swings wildly.

Driller is protected from jerk line

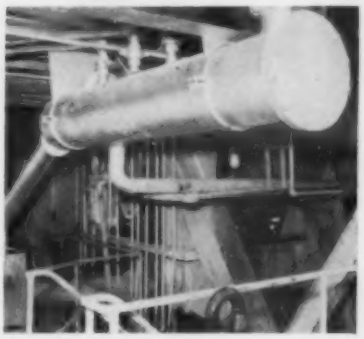
. . . Two simple safety devices

DRILLERS on A. W. Thompson Inc's new deep-hole Rig 1 are protected from the jerk line in two ways. The chain off the cathead passes through a cylinder made of scrap pipe as shown in Fig. 1. This pipe keeps the chain from falling.

Drillers have been injured when they stand on or close to a fallen chain that was engaged suddenly. As shown in Fig. 2, there is an expanded metal screen above the driller's console. This protects the driller in case the jerk line breaks or swings wildly.



CHRISTMAS TREE connects to preventers.



VESSEL placed under derrick floor.

Gas is handled when preventers are closed

ON a Golden Meadow Well Service rig working south of New Orleans, the system shown handles gas produced with the blowout preventers closed. A christmas tree on the derrick floor is connected to lines coming from the blowout preventers.

The two lines coming from the top of the tree are equipped with chokes to bleed off gas. The line on the right connects to a test separator in case it is desired to run a production test.

Beneath the derrick floor, the vessel shown connects to a 4-in. line from the surface pipe and to the high-pressure lines leading from the chokes above the floor. Coming out of the tank is the drilling-mud conductor to the shale shaker. The vent line for the gas is on the right.

This arrangement provides a safe means of handling the produced oil and gas when the blowout preventers are closed and it keeps the well in control while mud is conditioned.

Handy tubing tool used for racking

J. F. McADAMS, of Hobbs, N.M., is shown here with the tool that he uses to rack tubing when it is being laid down. He also uses the tool for pulling each joint so the elevator can reach it to lower the pipe into the hole.

The tool is made from ⅝-in. sucker-rod material bent into a hairpin shape with a pad on the front. The pad hooks down over the end of the tubing collar. The brace across the middle keeps it sturdy.

This tool allows the floorman to handle the pipe and keep his fingers free from contact with the pipe. Injuries are prevented and work is speeded up at the same time.

EVALUATING D.S.T. DATA—2

How Pressure-Buildup Theory Applies to Drill-Stem Test

In brief . . .

1. Boundary conditions used in deriving pressure-buildup equations are almost identical to reservoir conditions during drill-stem test.
2. Assumptions pertaining to reservoir homogeneity and radial fluid flow apply equally well to a drill-stem test or a completed-well test.
3. For practical purposes, rate of flow into well bore during open-flow period of a drill-stem test may be considered constant.
4. Since no appreciable annular fillup occurs after shutting in well during a drill-stem test, the pressure-buildup theory applies better to a drill-stem test than to a producing-well test.

by Albin J. Zak, Jr., and Phil Griffin III

Part 1 appeared in April 15 issue.

THE best method to show applicability of the pressure-buildup theory developed by Horner, and Hurst and van Everdingen to drill-stem testing is to go back to the basic assumptions and boundary conditions underlying the derivations of the modern pressure-buildup equations and show that they can be applied equally well to a drill-stem test. For convenience the assumptions and boundary conditions are:

Boundary conditions:

1. The reservoir is of infinite extent.
2. The inner boundary of the reservoir (the well bore) is considered vanishingly small.
3. Flow across the inner boundary is at a constant, steady-state rate.
4. The pressure at the outer boundary remains constant.

Assumptions:

1. The reservoir is homogeneous, horizontal, and of equal thickness throughout.
2. The flow obeys Darcy's radial-flow formula—neglecting entirely the effects of gravity.
3. The reservoir fluid is present in one phase only.
4. The compressibility and absolute viscosity of the reservoir fluid remain materially constant over the ranges of temperature and pressure encountered in the reservoir.
5. The fluid density varies exponentially according to:

$$\rho = \rho_o e^{-x}$$

where:

$$x = c (P_o - P).$$

Test conditions . . . Boundary conditions chosen for derivation of the pressure buildup equations fit almost perfectly the reservoir situation existing every time a drill-stem test is made. The low fluid withdrawals made during the test cause very small reservoir-pressure disturbances and the pressure at the outer reservoir boundary remains essentially constant.

Under these conditions, the reservoir may be considered infinite. The well bore can, for practical purposes, be considered vanishingly small due to its small size relative to that of the reservoir. The only boundary condition that does not seem to apply directly in the case of a drill-stem test is that of a constant, steady-state flow into the well bore.

Flow into well . . . Theoretical drill-stem-test pressure charts show that the open-flow pressure line varies in essentially a linear matter with time. This indicates constant fluid buildup in the drill pipe and a corresponding constant flow into the well bore.

An essentially straight-line open-flow pressure buildup was observed in more than 90 per cent of the drill-stem-test charts studied. Hence, for practical considerations, the rate of flow into the well bore may be considered relatively constant during the open-flow period of a drill-stem test.

Reservoir nature . . . The assumptions pertaining to reservoir homogeneity and radial fluid flow apply equally well to a drill-stem test or a completed well. In neither case can they be said to be strictly applicable, because they oversimplify the nature of the porous medium and the fluids which it contains.

Nevertheless, such sweeping simplifications are necessary in order to make a mathematical study of the subsurface flow of reservoir fluids. When it becomes necessary to make such a simplification, the resulting equations require considerable field testing in order to determine their usefulness and limitations.

In the case of the pressure-buildup-theory equations, field testing has shown that reliable results are obtainable from the equations even though in many cases the actual situation differs widely from the theoretical situation described by the assumptions.

Fluid properties . . . Of all the assumptions, the most doubtful as to appli-

Author Zak, now in the Armed Forces, plans to return to Core Laboratories, Dallas, on completion of his tour of service. Author Griffin is with Johnston Testers, Inc., Houston.

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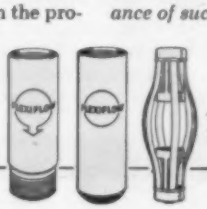

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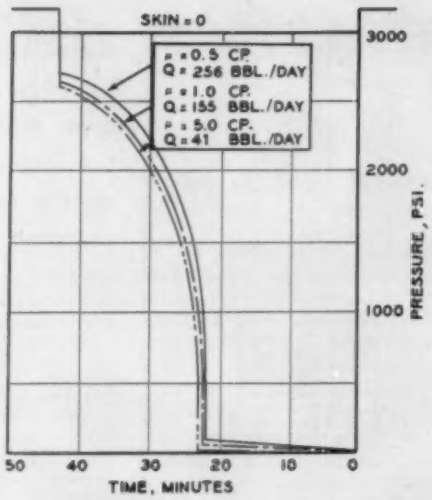
cability to a drill-stem test is the assumption stating that the absolute viscosity and fluid compressibility remain constant over ranges of temperature and pressure encountered in the reservoir. This is due to the relatively large variation in pressure during the test.

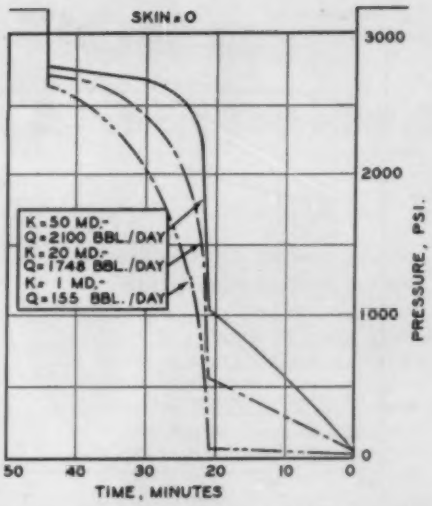
When the test tool is opened, essentially atmospheric pressure results, and the pressure then progressively increases during the test until the tool is pulled. A total pressure variation in excess of 3,000 psi. may be encountered.

However, analysis of the pressure - buildup curve uses only the straight-line portion for computation purposes; and this straight-line portion of the curve possesses a pressure variation seldom greater than 500 psi. and often the pressure variation is between 50 and 250 psi. So in reality, the pressure variation during a drill-stem test is not too large.

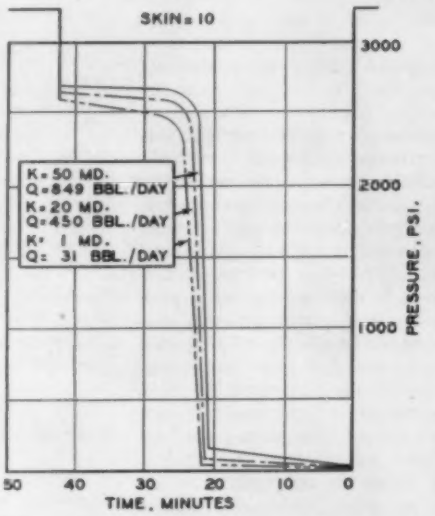
Referring back to Equation 1 (Part 1, issue of April 15), it is seen that viscosity enters the buildup equations as a product with the oil-volume factor. Although these quantities are sensitive to change with pressure, if their product change were small then any error created by their variation would be minimized.



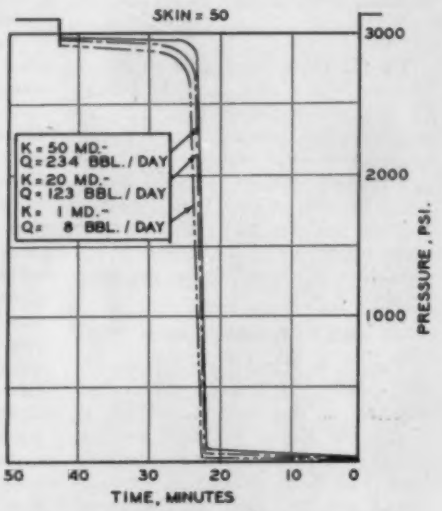
EFFECT OF VISCOSITY on shape of D.S.T. curve is not great but production rate is altered considerably. **Fig. 3.**



PERMEABILITY CHANGES can have a big effect on both the production and buildup curves. **Fig. 4.**



WELL-BORE DAMAGE lessens the effect of viscosity and permeability on the shape of the buildup curve. **Fig. 5.**



SEVERE SKIN causes production rate to change greatly with change in permeability. Pressure buildup is fast. **Fig. 6.**

Table 1 shows the relation between the viscosity and formation - volume factor of two crude samples. Note the relative constancy of the viscosity-volume factor product compared to the variation of the individual parameters. The remaining error is quite small.

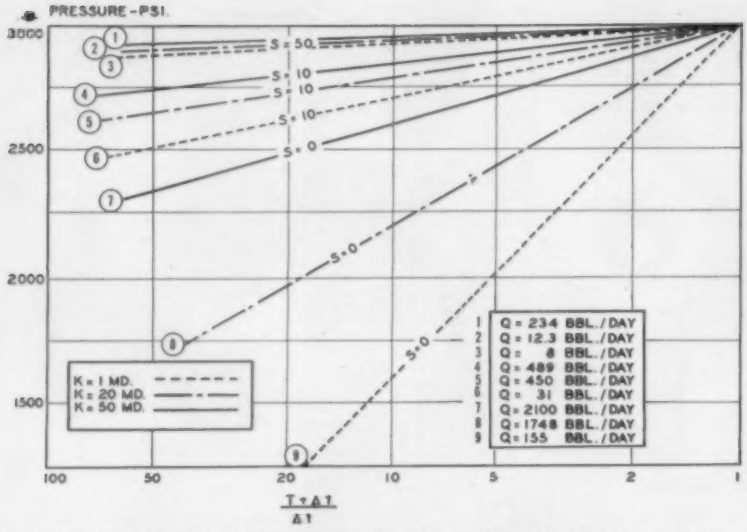
Based on this observation, it may then be concluded that the effect of variations in viscosity of the reservoir fluid during the drill-stem test have no practical significance in limiting the applicability of the pressure-buildup theory to drill-stem testing.

Use of chokes . . . One feature of drill-stem testing that decreases inaccuracies created by variations in viscosity and the presence of two-phase fluid flow (liquid and gas) in the well bore is the use of bottom-hole chokes in the test tool.

In an undersaturated reservoir, the pressure decrease imposed on the formation during the open-flow period of a drill-stem test allows gas to come out of solution and thereby bring about two-phase flow in the formation and a corresponding increase in the oil viscosity.

Bottom-hole chokes serve to limit this pressure decrease, but running a fluid cushion in conjunction with the choke would result in smaller pressure decreases, less gas coming out of solution, and restricted variations in oil viscosity. It is readily seen that a smaller pressure drop during flow would lead to better and more reliable pressure data. A procedure such as this could not be applied in the case of a completed well.

Shut-in time . . . The pressure buildup equation (Equation 1) in its final form could be modified for effects of annular fillup after shutting in the well. This is a most cumbersome mathematical procedure and is not included for practical application of the pressure-buildup analysis. In a producing well, the well is shut in at the surface and the formation continues to produce into the annulus until the annular space is filled or the fluid head has increased to the point of limiting fluid flow into the well bore.



THEORETICAL BUILDUP CURVES are affected drastically by skin factor and permeability. Note wide change of production rates. Assumptions are: viscosity, 1 cp.; thickness, 20 ft.; porosity, 20 per cent. Fig. 7.

On the other hand, in a drill-stem test, the well is shut in at the bottom of the hole, resulting in virtually no annular fillup, because there is simply no annular space which would allow appreciable afterflow from the formation. In this respect, the pressure-buildup analysis may be considered more applicable to the drill-stem test than to a pressure-buildup test on a producing well.

D.S.T. Pressure Curves

Figs. 3, 4, 5, and 6 are hypothetical drill-stem test pressure curves constructed to illustrate the effects of charges in Kh/μ, well-bore damage, and production rate. Certain reservoir-rock and fluid properties were assumed and the Hurst-van Everdingen and Horner methods were employed in making the actual calculations.

A comparison of curves for constant Kh/μ, with variations in viscosity and rate are shown in Fig. 3. The shape of the curves as well as the production change with an increase in viscosity. Similar changes occur with variations in permeability (Fig. 4).

It will be noted from Figs. 5 and 6 that when there is appreciable well-bore damage, variations in Kh/μ cause little change in the shape of the pressure-buildup curve. Nevertheless, even with a high well-bore damage the production rates differ greatly. For a given Kh/μ, the production decreases appreciably with an increase in well-bore damage as shown by comparison of Fig. 5 and Fig. 6. Furthermore, the final flowing pressures, P_f, are proportional to the fluid head in the drill pipe, and as the flow periods are the same, these pressures are also proportional to the production rates.

Calculations . . . Every attempt was made to make the hypothetical drill-stem test as near a true drill-stem test as possible. Each incremental production rate was sustained against back pressure resulting from the fluid head increase just prior to the time interval of interest. In other words, during each time increment, production was sustained against an already existing fluid column in the drill pipe. After each time interval, the fluid head increased by the amount of fluid produced during the interval. The only factor not considered was that of bottom-hole chokes which do not exert their influence too greatly unless the well has a very large productivity.

Equations 1 and 3 (Part 1) were used to compute pressure behavior for well-bore damage S = 10 and S = 50 as shown in Fig. 5 and Fig. 6. A value of P_f was chosen and Equation 3 was solved for the slope m. For comparative purposes, the values of P_f chosen were those values determined from the initial calculations where well-bore damage was zero. Using Equation 1, the average production rate Q was computed.

Knowing m enabled construction of the semilog pressure-buildup plot, log $(T + \Delta t)/\Delta t$ versus pressure. The pressures from the semilog plot were then translated to the drill-stem-test pressure-buildup curve.

Since the pressure recorder in a drill-stem-test tool records essentially the pressure due to fluid fillup in the drill pipe, the open-flow pressure was plotted proportional to the height of fluid in the drill pipe at any time T, as governed by the production rate Q.

A composite semilog plot of the buildup curves is shown in Fig. 7. For these calculations the following assumptions were made: $r_w = 4.5$ in.; $h = 20$ ft.; $f = 0.20$; $\mu = 1.0$ cp.; $c = 10^{-5}$ per psi.; $B = 1.0$. **End.**

"... field testing has shown that reliable results are obtainable from the equations even though in many cases the actual situation differs widely from the theoretical situation ..."

TABLE 1
P.V.T. Relations for Two Crude Samples Showing Relative Constancy of Viscosity-Volume Factor Product

P.V.T. Data, West Texas Field
(Differential liberation at 220° F.)

Pressure (psi.)	Relative oil volume factor	Viscosity centipoise	(Volume factor) × (viscosity product)
3,800	1.372	0.958	1.315
3,600	1.375	0.941	1.294
3,400	1.378	0.922	1.270
3,200	1.382	0.910	1.259
3,000	1.385	0.898	1.245
2,800	1.389	0.881	1.224
2,695		(Bubble point)	
2,600	1.383	0.890	1.230
2,400	1.360	0.920	1.251
2,200	1.338	0.951	1.273
2,000	1.323	0.988	1.308
		Avg. =	1.267

Maximum deviation from mean

$$= \frac{1.267 - 1.315}{1.267} \times 100 = 3.8 \text{ per cent}$$

P.V.T. Data, New Mexico Field
(Differential liberation at 146° F.)

Pressure (psi.)	Relative oil volume factor	Viscosity centipoise	(Volume factor) × (viscosity product)
3,600	1.570	0.366	0.575
3,400	1.575	0.356	0.561
3,200	1.578	0.332	0.524
3,000	1.582	0.322	0.510
2,800	1.585	0.312	0.495
2,697		(Bubble point)	
2,600	1.565	0.318	0.498
2,400	1.523	0.343	0.523
2,200	1.487	0.372	0.553
2,000	1.453	0.400	0.581
1,800	1.423	0.426	0.606
		Avg. =	0.5426

Maximum deviation from mean

$$= \frac{0.543 - 0.606}{0.543} \times 100 = 11.6 \text{ per cent}$$

How Much AUTOMATION

. . . in processing plants?

by A. Ray Wagner

AUTOMATION is not a method, a machine, or a process. It is the logical application of all technologies and sciences to a particular problem with the object being production at a higher rate, lower cost, and better quality. Although this discussion will deal primarily with the application of instrumentation, we must not overlook the fact that the selection and performance of all related equipment is an all-important factor in achieving the end result.

Automation Not New

Automation in the natural gasoline industry is not something new. Automatic controls and devices of various kinds have been used in our business since the beginning. The first steam governor was devised in 1881, and governors were used on engines and turbines in our earliest plants. These devices were used because in each case they could control speed better than even a skilled operator manually attempting to do the same job. With the advent of stabilizers and absorbers in the gasoline plant, it was soon realized that an instrument that could sense a condition, record this variable, and then control it accordingly, was a necessity, and in the late 1920's, our first recorder-controllers were used.

In the 30's, these instruments were refined and developed to the extent that excellent control over the processing plant could be obtained. Also developed in this period were electronic temperature recorder-controllers, which were excellent instruments and minimized the lag between the sensing point and the instrument. Little was done in this era in our compressor rooms, except for, possibly, the addition of devices for shutting down the engine in case of low oil pressure, high jacket temperature, or overspeed.

Miniature . . . In the 1940's a step forward was made with the introduction of miniature-panel-mounted pneumatic instruments. These instruments operated from a transmitter located at the sensing point, and had many refinements over the older-type instruments. The recorder-controller units occupied a space approximately 6 in. square. This made feasible the use of a central control room with a graphic-type panel. These panels, which are greatly reduced in size compared to one using standard case instruments, contained a flow chart of the plant with the instruments actually placed in their respective positions on the flow sheet.

Author is consultant at Tulsa. Paper presented at Thirty-sixth Annual N.G.A.A. meeting at Houston, April 24-26, 1957.

Field Processing

Electronic . . . A big development in the last few years is the use of miniature electronic instruments. These instruments are rugged and have quick responses between the sensing point and the control valve, as well as other flexibilities. They are similar to modern-type pneumatic instruments, except that they use electronic servo-type circuits, thus increasing sensitivity and closeness of control.

New Equipment

Automation in our industry is not new, but there is still much to gain by the use of equipment now being developed. The television industry, the guided-missile program, and the aircraft industry have made necessary developments in the electronic field, which have provided us with a vast array of equipment, which can be utilized in our industry. Some of these things are transistors, printed circuits, subminiature switches, numerical indicator tubes, hermetically sealed plug-in relays, and various types of hardware by which any type of unit can be fabricated and incorporated into a plug-in device.

There is a subminiature switch, single-pole double throw, rated at 5 amp. at 250 volts. Two or three dozen can be held in one hand. There is a hermetically sealed plug-in relay, which utilizes three of these small switches, all of them being actuated by a lever from the holding coil. There is a numerical indicator tube, which is a plug-in device, and which will light up any number from 1 to 10 depending on which terminals are energized. All of these newer developments make possible dependable and rugged systems for controlling, indicating, scanning, logging, signaling, alarming, etc.

Compressor and Auxiliary Rooms

Little has been done in recent years with automation in our compressor and auxiliary rooms. In most plants, it is still a manual function to take oil from a source of supply and pour it into the crankcase and lubricator of a compressor. Oil-level regulators have been developed now, however, so that this operation can be entirely eliminated, and a plant can be equipped for complete automatic lubrication with metering for each engine if desired.

Regulating compressor volume . . . In most plants, the control of the compressor volume is still a manual operation, and the operator in charge uses various methods for regulating this volume. In some cases he may open clearance pockets, in others pinch suction valves, and some may shut down or start up an engine. Some plants are now being provided with equipment for regulating the speed of compressors according to the gas volume available. Governors are now made which will operate from a standard 3-15-psi. air signal or an electronic signal, and it is a simple matter to connect a pressure controller to these governors for regulation of speed. It is believed that a decrease in maintenance will develop as a result of this reduction in r.p.m. and with operation at a constant compression ratio.

Some pipeline stations now utilize a control unit for shutting down an engine and for automatically starting up this engine and loading the compressor. As a matter of fact, there are stations now running, which are fully automatic, unattended, and controlled from a remote point.

Automatic shutdown . . . In most plants, however, this is still a manual operation usually involving two men and sometimes taking as much as 30 minutes to place a unit back on the line. There are now being developed, however, engine-control units specifically designed for gasoline-plant operation. These units will shut down the engine due to overspeed, high jacket-water temperature, low oil pressure, knock, or high scrubber level. They pin point the trouble by a pilot light, close the main fuel valve,

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and sequentially unload the compressor.

Automatic starting and loading . . . They will also automatically start the engine and sequentially load the compressor. The unit contains relays and timers, which energize either pneumatic or electric valve operators on the starting air, fuel, compressor suction, discharge, bypass, and blowdown valves. They are also arranged so that an outage of 110-volt electricity will allow a relay to drop, so that the engine continues in operation except when any malfunctioning occurs, which directly grounds out the magneto.

The gaging and switching of tanks around a large gasoline plant is still, in nearly every case, a time-consuming manual function. There are available now, however, several types of tank-gaging equipment which can be used. Some of these on atmospheric tanks utilize a simple float arrangement with the reading being digitalized for transmission to a remote point. Others use an electronic level-sensing probe, with the reading again being digitalized before transmission. Most of these devices, however, are designed for use in the pipeline industry and present some problems when attempting to use them around a gasoline plant with a large number of horizontal pressure storage tanks. The reading from any of these tank-gaging devices may be brought electrically to a central point, or if the distance is great, by telemeter.

Electronic d.p. transmitters . . . For plants where sales are not made on the basis of tank gage, electronic differential-pressure transmitters present a simple and inexpensive level-sensing device. These units are accurate to approximately 0.5 per cent, and where the span has been set for the product used at 60°, tend to correct the reading for temperature. This system now being installed at one plant also incorporates a dialing system in order to eliminate a large amount of wire.

In this case, the telephone dial and stepper switch are located at the operator's console, with another stepper switch and relays in the storage area. The receiving device is a drum-type indicator with imposed scales for various diameter tanks. When the operator dials a tank number, this number is shown below the dial with numerical indicator tubes actuated from the stepper in the console, and a light comes on under the appropriate scale on the drum indicator.

This same plant also utilizes pneumatic and electric operators on the make and suction valves, so that the entire storage operation may be han-

dled from the operator's console. The switches used for these valves are a new type in which the pilot light is built into the plastic push button, thus showing the operator the position of each valve on each tank.

Process Control

In the process area of our type of plants, the new electronic and pneumatic equipment now available provides excellent control for process streams and for control of various absorbers, stills, and fractionating towers. A new thought on the miniature panels and the location of miniature-panel instruments, is to group instruments for each complete process unit together and use a miniature graphic layout above the instruments. This miniature graphic, which is only about 18 to 24 in. tall, has only alarm lights in the form of name plates at the control points. This arrangement allows an even smaller panel than the standard graphic and still possesses most of the advantages.

Data Logging

The electronic developments mentioned before also make possible systems for automatically scanning temperatures and other variables, and for logging these values if desired. Complete scanning systems are now commercially available and loggers can also be purchased for periodic printout on an electric typewriter to show any quantity or condition in the plant.

Loggers, however, will probably not be used in gasoline plants to any great extent in the immediate future for several reasons. One is that the process conditions in a gasoline plant change very little from day to day or week to week and the logging of such variables as temperature, pressure, flow, and etc., is of little value. The recording of production and other pertinent data can easily be done by the operator on tour, and the logger would not, under these conditions, either replace a man or make his job much easier.

These units, at their present stage of development, are also expensive and contain a complexity of transducers, timers, steppers, relays, etc., and would probably add to the technical maintenance required at the plant.

To supplement the pneumatic and electronic controller in our process area, there are now being developed certain continuous-analysis devices or methods such as infrared, mass spectrometry, refractometry, chromatography, densitometry, radiology, and vapor pressure. Some of these devices are now commercially available, and are equipped with a millivolt or pneumatic output, which can be used to

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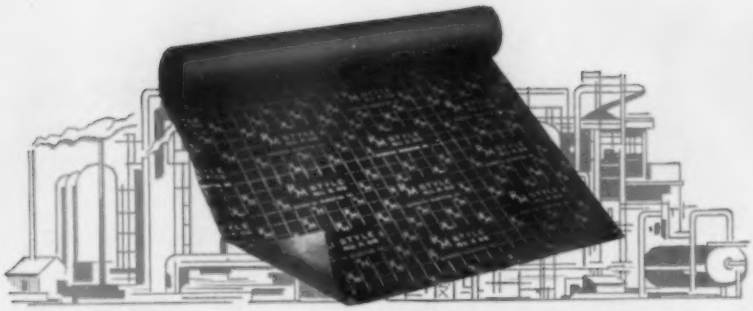
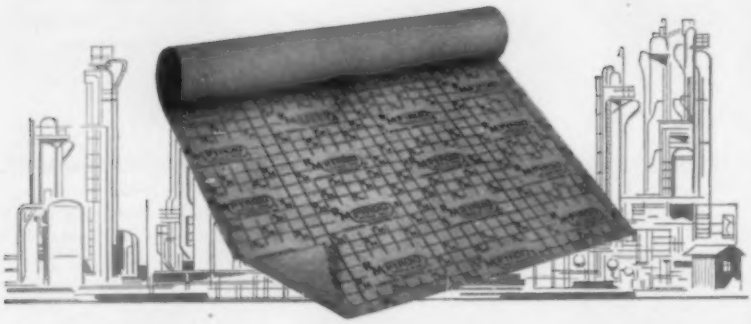


REDUCE MAINTENANCE COSTS



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PACKING DIVISION, PASSAIC, N.J.
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FACTORIES: Passaic, N.J.; Bridgeport, Conn.; Manheim, Pa.; Neenah, Wis.; No. Charleston, S.C.; Crawfordsville, Ind.; Peterborough, Ontario, Canada

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reset the set point of the basic controller.

Control of Steam Plants

Newer-type steam plants are all equipped with instrumentation, which lends itself well to transmission of the pertinent levels, pressures, and temperatures to a central control room. In the older plants with oil-field-type boilers, there is also equipment available for transmitting boiler-water levels and important pressures back to a central point. The receivers for boiler-water level may be the new ribbon indicators, which present a realistic simulation of levels by use of a bright red ribbon.

Scanning-type pressure gages are also available, in which the entire gage may be revolved until at normal operating pressure the gage hand is at the 12 o'clock position. Any deviation from the normal pressure is immediately obvious to the operator. For bringing the pneumatic signal from the boiler room or from any point in the plant to the central control room, there has been developed in the last few years, multicolored plastic tubing with any number of these tubes incorporated in a plastic harness. This can be installed for a fraction of the cost of using single copper tubes.

The maintenance of this equipment will present some problems, but will probably not be as much as most people expect. The existing instrument maintenance personnel at most plants should be able to handle most of the problems, except that a knowledge of electronics and electricity would be desirable for electronic control equipment. The actual repair of the new electronic recorder-controller devices will probably not impose any great problem since the entire unit, which is made up of a group of plug-in components, may be unplugged and replaced.

Preventive-maintenance program . . . Such a program for instruments at any modern gasoline plant would probably be beneficial, and in any large gasoline plant it would be desirable that some one of the maintenance personnel be trained as an instrument technician. In smaller plants, the plant chemist or some other technical supervisor could probably take care of this phase. The operator for the modern gasoline plant will be responsible for a much larger amount of equipment, but he will have much more help in the way of instrumentation so that his job will be physically easier. His job will be more technical and experience will of course be a necessary requirement. **End.**

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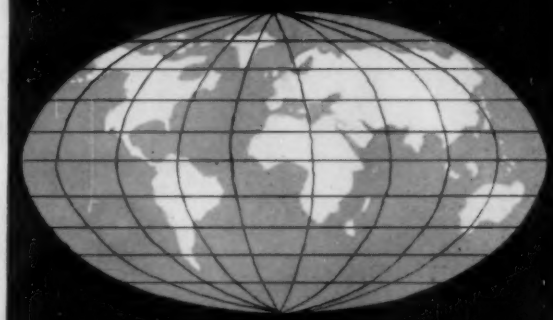

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It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

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No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature automatically maintained.

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75 pounds in a single stage.

NASH ENGINEERING COMPANY

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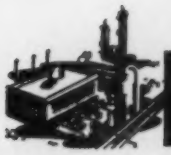
Heat Transfer
Part 13



THE FOREMAN'S PAGE

Refining • Petrochem • Natural Gasoline

JOB IMPROVEMENT FOR THE PROCESS FOREMAN—87

Why Do Refineries Use Fired Heaters?

AN example of radiation in the furnace is the heat received by those tubes located in the firebox. Most of the heat comes on a direct line from the burner through the intervening space to the tubes, or else it is reflected to the tubes after striking the furnace wall. This part of the furnace is generally known as the radiant section because the greater fraction of total heat transferred in a well-fired furnace is by the mechanism of radiation. Most heaters are designed for 70 per cent addition of heat by radiation and 30 per cent convection.

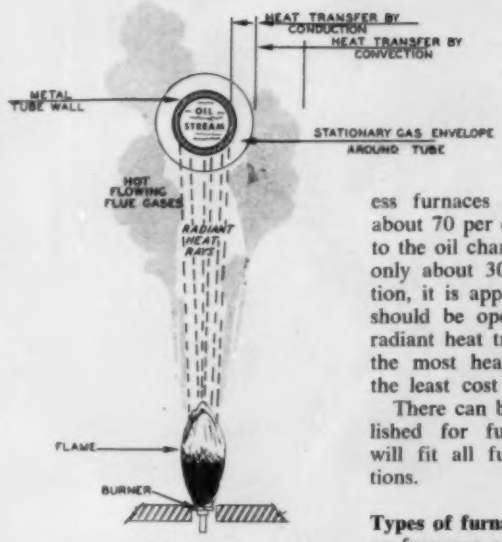
The amount of heat a flame will radiate is proportional (to the fourth power) to the temperature of the flame. Proper adjustment of the excess air to the furnace and the condition of the furnace tubes are factors in obtaining high furnace efficiency. Correct adjustment of the excess air insures highest possible flame temperature, and tubes that are free of scale, coke, dirt, etc., will give the highest rate of heat absorption.

Furnace convection . . . Convection takes place in the furnace when the hot combustion gases give up heat to the cooler flue gases that exist around the outside of the furnace tubes. Convection occurs, as does radiation and conduction, in each section of the furnace. However, it is the principal means of heating the oil before it enters the radiant section. As the flue gases leave the firebox on the way to the stack they give up heat to the charge in a series of tubes. This part of the furnace is known as the convection section.

The amount of heat transferred by convection is dependent on the following conditions:

1. The difference in temperature between the hot flowing gases and the gas film around the tubes, the greater the difference the more heat transferred.

2. The velocity of the gases. The greater the velocity, the greater the rate of heat transfer.



HEAT transfer from flame to oil in furnace tube. Fig. 12.

Furnace conduction . . . Conduction in the furnace is the mechanism of transferring heat through the metal wall of the tube to the material flowing within the tube. This type of heat transfer is dependent on contact, either from one body to another, or in the same body. An example of conduction in the furnace is the process of moving heat from the outside wall of the tube through one body, the metal, to the inside wall. There the moving liquid contacts the hot surface and is heated.

Heat transferred in this manner depends on:

1. The difference in temperature between the outside of the tube and the inside of the tube. Greater difference results in greater heat transfer.

2. The thinness of the gas film and the tube wall. The thinner they are, the more heat transferred (see Fig. 12).

Furnace operation . . . As the process furnaces are designed so that about 70 per cent of the heat added to the oil charge is by radiation and only about 30 per cent by convection, it is apparent that the furnace should be operated for the highest radiant heat transfer. By this means the most heat can be added with the least cost of fuel gas.

There can be no rigid rules established for furnace operation that will fit all furnaces and all situations.

Types of furnaces . . . Fired heaters or furnaces are used in petroleum refining for one or more of the following reasons:

1. To increase the temperature of oil and, therefore, its volatility so that it can be flashed or distilled into its several boiling range components.

2. To increase the temperature of the oil to the point where cracking or thermal decomposition will occur.

3. To increase the temperature of the oil or oil vapor to the point at which catalytic cracking will occur when catalyst is contacted.

4. To maintain oil at the cracking temperature by supplying the heat of cracking. This is called soaking.

5. To heat an oil or other medium for the purpose of transferring heat at some other location or to maintain an oil or other fluid above the solidification point to make it pumpable.

In all these cases, except sometimes in Case No. 4, the temperature of the oil is increased, therefore, the primary function of furnaces used in petroleum processing is to increase the temperature of the oil.

This material is taken from "Fundamentals of Refining," operating manual of Magnolia Petroleum Co., refining division, Beaumont, Tex.

Mill scale removal by Dowell started this new plant off with a $100,000 operating profit

Here's how the management of a multi-million dollar corporation used its knowledge of chemical cleaning to start a new plant off in the right way—in the black.

Following construction, and before the plant was put on stream, Dowell was called in to remove mill scale from the following systems:

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The total cost of this mill scaling was approximately $5,000. But, once in production, this plant did not have a single major shut down for maintenance caused by mill scale. The plant management credits Dowell Service with netting the plant an operating profit somewhere between 10 and 20 times the cost of the chemical cleaning. This amounted to between $50,000 and $100,000 the first year.

This particular case history is about a chemical company, but Dowell has startling performance data to show you—from your own industry. That's because chemical cleaning is so versatile. Dowell engineers are experts in removing scale and sludge from process systems, tanks and piping. They apply solvents in various ways—such as filling, jetting, cascading. Dowell furnishes all the necessary chemicals, trained personnel, pumping and control equipment.

For specific information on how chemical cleaning can help you to greater profits, call the Dowell office near you. Or write Dowell Incorporated, Tulsa 1, Oklahoma.

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Gulf Coast Expansion Plans

A

American Oil Co. is increasing Ultraforming capacity by 21,000 bbl. per day, and hydrofining (Ind.) capacity 22,000 bbl. per day at Texas City, Tex. Ralph M. Parsons Co. has contract. Completion is scheduled for February 1958.

Atlantic Refining Co. will build a 2,100-bbl. per day alkylation unit at Port Arthur, Tex., to operate in conjunction with a new 15,000-bbl. per day Catforming unit.

C

Chemoil Corp. will complete a new refinery between New Orleans and Baton Rouge, La., by December 1958. It will have a crude capacity of 22,000 bbl. per day, a 10,000-bbl. per day vacuum unit for charging topped crude, a 14,000-bbl. per day gas-oil cracking unit, a 5,000-bbl. per day naphtha reforming unit, a 9,000-bbl. per day delayed coker, a 3,000-bbl. per day hydrofluoric acid alkylation unit, a 1,000-bbl. per day catalytic polymerization unit, and coke production of 350 tons per day. The plant also will include a hydrogenation unit.

Cities Service Refining Corp. will increase crude capacity 15,000 bbl. per day at Lake Charles, La., by June 1958. In 1957, fluid catalytic cracking capacity will be increased by 19,000 bbl. per day by June, and alkylation capacity will be increased 1,000 bbl. per day by September.

Corpus Christi Refining Co. has under way a $560,000 modernization program at Corpus Christi, Tex. Plant will be idle until June 1957.

D

Delhi-Taylor Oil Corp. will increase Platforming capacity 10,500 bbl. per day and add a 15,000-bbl. per day Uniformer at Corpus Christi, Tex., by June 1957. Engineering and design are by Refinery Engineering Co. and U.O.P. Cost is close to $7,000,000.

E

Esso Standard Oil Co. will increase sulfuric acid alkylation capacity 1,000 bbl. per day at Baton Rouge, La., by June 1957. Gas-oil cracking capacity will be increased by 5,000 bbl. per day and lube production by 150 bbl. per day by December 1957.

Evangeline Refining Co., Inc., will add a 1,000-bbl. per day Catformer at Jennings, La.

G

Gulf Oil Corp. will increase Platforming capacity 26,000 bbl. per day at Port Arthur, Tex., by early 1958.

H

Humble Oil & Refining Co. will complete two hydrodesulfurization units with 90,000-bbl. per day capacity at Baytown, Tex., by January 1, 1958. Ralph M. Parsons Co. is contractor. A 55,000-bbl. per day fluid catalytic cracker with no recycle will be completed February 1, 1958. Engineering and design of the catalytic cracker are by Foster Wheeler Corp. and Humble.

L

Lake Charles Chemical Corp. will complete by September 15, 1957, a 10,000-bbl. per day delayed coker to produce 330 tons per day of coke at Westlake, La. Fluor Corp., Ltd., is contractor.

M

Magnolia Petroleum Co. will complete a 100,000-bbl. per day atmospheric distillation unit and a 32,000-bbl. per day vacuum unit for charging topped crude (both to replace some existing capacities) at Beaumont, Tex., by March 1958. Foster Wheeler Corp. is contractor. A 30,000-bbl. per day Sovafiner will be completed, and sulfuric acid alkylation capacity increased 8,000 bbl. per day by March 1958. Engineering and construction is by C. F. Braun.

N

North American Petroleum Corp. plans a new refinery at Corpus Christi, Tex. Site has been purchased, but plant is not yet under construction.

P

Phillips Petroleum Co. will build a 16,000-bbl. per day low-end-point catalytic reforming unit, plus desulfurization facilities, at Sweeny, Tex. Fluor Corp., Ltd., is contractor. Construction will start July 1, 1957, and completion is scheduled for January 1, 1958.

Pontiac Eastern Corp. will complete an 11,000-bbl. per day refinery at Hattiesburg, Miss., by September 1957. Construction and engineering are by Fluor Corp., Ltd. The plant will include a 3,500-bbl. per day fractionation unit for purchased distillates, a 4,800-bbl. per day fluid coking unit, a 25,700-bbl. per day T.C.C. unit with 63 per cent recycle, a 2,500-bbl. per day sulfuric acid alkylation unit, coke capacity of 225 tons per day, a 1,200-bbl. per day Unifiner, and a 2,500-bbl. per day Platformer.

S

Seminole Oil Co. has indefinite plans for a refinery at Fort Pierce, Fla., to be operated by Frontier Refining Co.

Sinclair Refining Co. will increase Hydrofining capacity 24,000 bbl. per day at Houston by September 1, 1957. Ralph M. Parsons Co. is contractor.

Southland Co. plans a 15,000-bbl. per day refinery at Black Point, Fla. Site has been purchased.

Sunshine State Refineries, Inc., plans a 10,000-bbl. per day refinery at Plant City, Fla.

Suntide Refining Co. will complete a 15,000-bbl. per day Rexformer and a 7,500-bbl. per day Unifiner at Corpus Christi, Tex., by June 1957. A 7,500-bbl. per day BTX Udex will be completed by September 1957, and capacity of vacuum unit charging topped crude will be increased 8,500 bbl. per day by October 1957. Refinery Engineering Co. is contractor.

T

Texas City Refining, Inc., will increase Houdriflow capacity 1,000 bbl. per day with no recycle, and will add a 7,000-bbl. per day Houdriformer and a 7,000-bbl. per day Houdry hydrogenation unit at Texas City, Tex., by late 1957. Catalytic Construction Co. has contract for the Houdriformer. Cost will be $2,000,000.

The Texas Co. will increase crude capacity 20,000 bbl. per day at Port Arthur, Tex., by January 1, 1958. Fluor Corp., Ltd., is contractor. Capacity of vacuum unit charging topped crude will be increased 32,000 bbl. per day by January 1, 1958. By April 1, 1958, M. W. Kellogg Co. will have completed work to increase fluid catalytic cracking capacity 90,000 bbl. per day with 33.3 per cent recycle.

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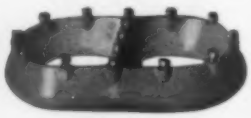

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North Texas Rotary Rig Makes Fast Time In Wells Completed and Footage Drilled

Drilling 16 wells, totaling 101,928 ft. of hole, in 295 days is a record set by a rotary rig operated by Graytex Drilling Co. in the Whitesboro area, Grayson County, North Texas.

The wells ranged in depth from 5,100 to 7,494 ft. Over-all time averaged 18.43 days per well. Total footage drilled averaged 345.5 ft. per day.

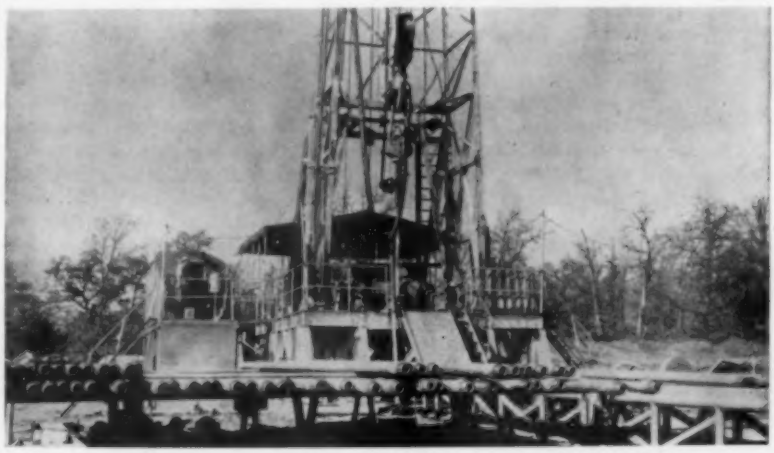
The rig was a National T-32 assembly. It is powered by two Le Roi L-3000 gas engines, one on the draw works and rotary, and the other on the independently powered National C-250 slush pump. It is equipped with Foster catheads, a midship torque converter, and a hydromatic brake. Its 129-ft. mast is on an 8-ft. substructure.

Drilling was with 4½-in. 16.60-lb. Spangweld drill pipe, using 6¼-in. by 30-ft. drill collars.

Depths and time required to complete the 16 wells, in the order of wells drilled, follow:

Depth (ft.)	Operating days
6,100	10
5,394	12
5,555	10
7,304	31
7,434	27
4,030	10
6,570	17
6,578	20
6,490	17
6,532	17
7,426	29
6,495	16
6,614	18
7,494	19
6,555	17
6,357	25

Graytex has been operating about 4 years. Principal owner is Jerry Moore. The company also operates a National T-8-S rig in the same general area.



THIS IS Graytex Drilling Co.'s rig which set fast drilling record in Whitesboro area, Grayson County, North Texas.

Doran Drilling Co. has a rig working for Exeter Oil Co., Ltd., on a new operation in the Freeman area, 2 miles north of Dinero, in southeastern Live Oak County, in the central coastal area of South Texas. It is a 6,000-ft. test at 1 Vann, in the S. Simmons Survey.

Eggleston, Inc., is contractor on an 8,500-ft. wildcat test Salt Dome Production Co. and Harry Hurt, of Houston, are starting about 2¼ miles southeast of East Perkins field, southeast of DeQuincy, in northern Calcasieu Parish, southwestern Louisiana. Location is on Sun Oil Co. fee land in 6-8s-9w.

Iraq Drilling Co. is drilling for J. G. Walker, Jr., of Tyler, Tex., on a new operation in the North Jacksonville area of northern Cherokee County, East Texas. It is on the operator's Burns lease in the Mitchell McKay Survey. Location is at the north end

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of production about 5 miles southwest of Troup. A 4,500-ft. test is planned with Woodbine as the objective.

Brown Drilling Co., Long Beach, Calif., is drilling Western Gulf Oil Co.'s second test in the new Arbuckle area, in Colusa County, northern California. The test, 1 Arbuckle Unit D, in 10-13n-2w, is about a half mile southwest of Western Gulf's gas-discovery well completed last January. That well was productive from sand at 5,580-5,608 ft. The confirmation test may be carried to 7,000 ft. The area is 12 miles southwest of nearest gas production in Meridian field.

Gilmour Drilling Co., Alice, Tex., is to drill another test in the new Roos Wilcox area in southern McMullen County, South Texas, for Argo Oil Corp. It will be a long stepout, about 5,800 ft. southwest of a test Gilmour now is drilling for the same operator, and about 15,000 ft. southwest of the field's discovery well. The new contract is for 1 Stischer, in Section 111. It is for 8,250 ft. The discovery well's Wilcox pay is at a depth of about 7,500 ft.

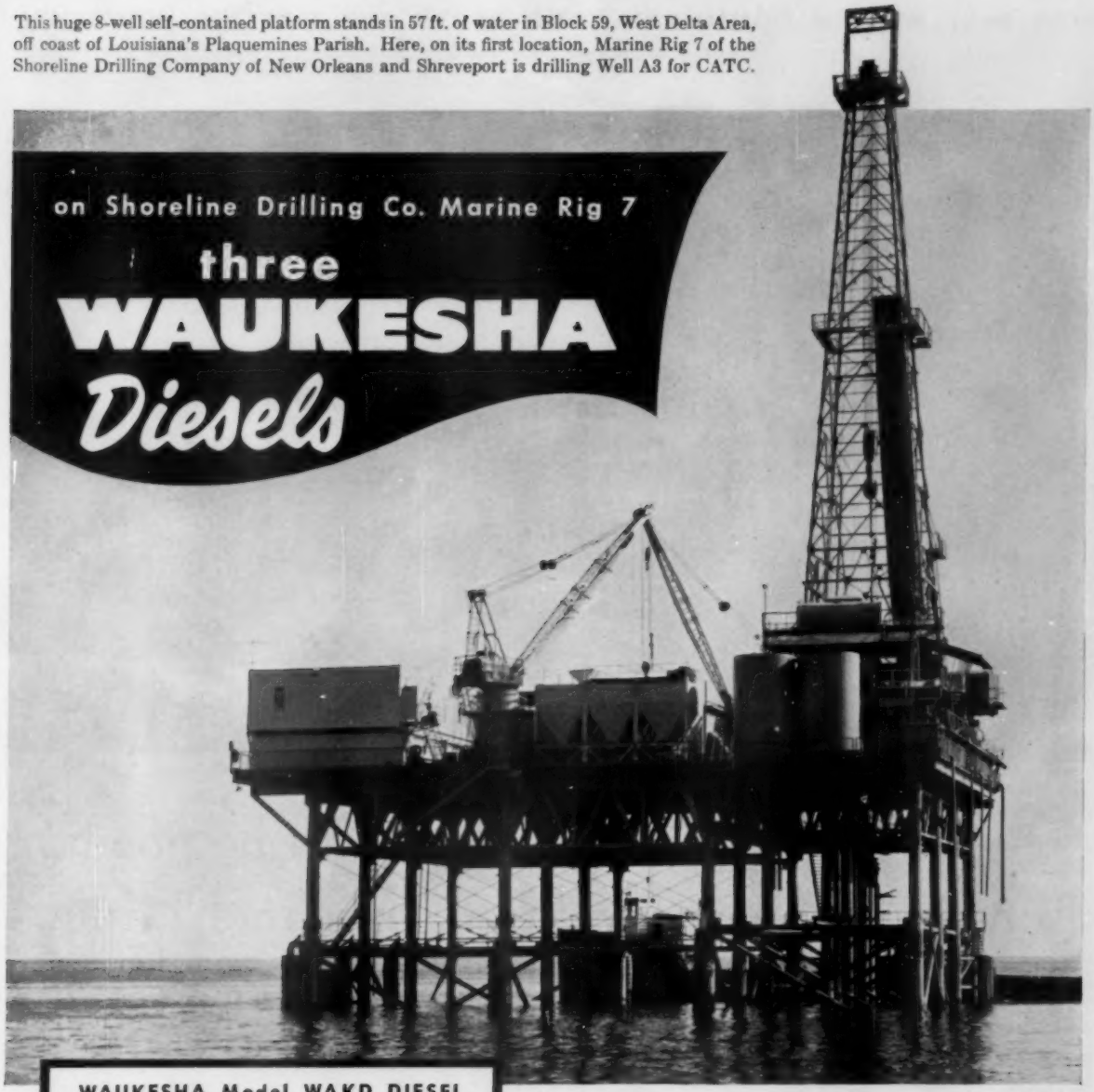
B. & B. Drilling Co. is contractor on a rank wildcat test L. M. Glasco, of Dallas, is to drill in northwestern Greene County, in West Central Alabama. Location is for 1 Norwood, in 17-23n-1w. It is about 3 miles southwest of Ridge, and about 5 miles northwest of Clinton. Nearest production is more than 75 miles south in the Gilbertown area, of Choctaw County.

Barron Drilling Co., Farmington, N. M., has a new wildcat operation in the Westwater area of Grand County, eastern Utah. It is a contract job for Oil, Inc., and others. Location, on federal land in 13-17s-23e, is about 11 miles west of Bar X-West field. It is a 5,600-ft. test.

Great Northern Drilling Co. has a rig working on contract for McAlester Fuel Co. at a wildcat location 3 miles east of Northwest Sumatra field, in Rosebud County, Montana. It is McAlester's 1-A state, in 16-11n-33e. Objective is the Heath formation about 6,000 ft.

Creighton Drilling Co., Tulsa, is on a well-deepening job in the West Palacine area of Stephens County, southern Oklahoma. It is for Ambassador Oil Co. The well, drilled by C. V. Richardson to 3,833 ft., will be deepened to the Arbuckle about 4,300 ft. Ambassador has changed the well name from 1 to 2 McPhair. The well is an offset to the field's discovery well.

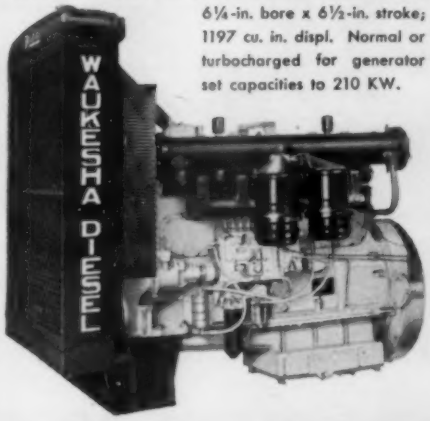
This huge 8-well self-contained platform stands in 57 ft. of water in Block 59, West Delta Area, off coast of Louisiana's Plaquemines Parish. Here, on its first location, Marine Rig 7 of the Shoreline Drilling Company of New Orleans and Shreveport is drilling Well A3 for CATC.



on Shoreline Drilling Co. Marine Rig 7

three WAUKESHA Diesels

WAUKESHA Model WAKD DIESEL



6¼-in. bore x 6½-in. stroke; 1197 cu. in. displ. Normal or turbocharged for generator set capacities to 210 KW.

337

each of the three 100 KW auxiliary power plants has its Waukesha WAKD Diesel

On Shoreline's Marine Rig 7 . . . a modern marvel of packaged efficiency . . . dependability is more important than ever. That's undoubtedly why Waukeshas were chosen for the auxiliary power plants. The power performance and rugged reliability of Waukesha Power has been repeatedly proved for every oil field need. Send for bulletins on Waukesha WAKD Diesel Series. *Waukesha Motor Company, Waukesha, Wis., New York, Tulsa, Los Angeles.*

WAUKESHA Engines and Power Units: 10 hp to 1135 hp—LP Gas • Natural Gas • Normal and Turbocharged Diesels—Get Bulletin 1079

HOW BELL SYSTEM COMMUNICATIONS SERVE THE PIPELINE INDUSTRY

Construction men fought terrain and bitter cold in the construction of PNW's "scenic-inch" pipeline.

Why communications have to be good on Pacific Northwest's "scenic-inch" line

Pumping gas over mountain passes across 1487 miles of America's toughest terrain requires the most reliable communications available.

Pacific Northwest Pipeline Corp. presented this requirement to the Bell System, with one additional request—economy.

The result is a private line telephone system that PNW's Salt Lake City control center uses to keep a running summary of conditions along the line. Information gathered in Salt Lake City from each compressor station includes dew point, BTU content and specific gravity of the gas. Dispatchers use this data as guidance in controlling flow.

• • •

Bell System communications can work for you as fast and reliably. Just call your Bell Telephone Company business office. A representative will gladly discuss your requirements.

Pacific Northwest's Salt Lake City dispatchers collect data hourly from every compressor station and maintenance point on the company's 1487-mile pipeline.

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PRIVATE LINE TELEPHONE • PRIVATE LINE TELETYPEWRITER DATA TRANSMISSION SYSTEMS • CHANNELS FOR: REMOTE METERING AND CONTROL • TELEPHOTOGRAPH • CLOSED CIRCUIT TV

Pipeline Patrol

. . . Report on Construction

PIPELINE activity reported here is compiled from surveys conducted by The Oil and Gas Journal among pipeline companies and contracting firms. Projects listed include those proposed, contracted, and under way. Uncontracted projects are indicated by • preceding the project.

U.S. Crude-Oil Pipelines

• **Cape Pipe Line Co.** (organized by Sun Oil Co., Cities Service Co., Atlantic Refining Co.)

Project: Long range plans for line on the lower Delaware Bay to the Philadelphia refining area.

Completion: 1960.

Four-Corners Pipe Line Co. (newly formed by Shell Oil Co., Standard Oil Co. of California, Continental Pipe Line Co., Gulf Oil Corp., Richfield Oil Corp., Superior Oil Co.)

Project: 600 miles of line from near Farmington, N. Mex., in the Four Corners area to Los Angeles, to be constructed and operated by Shell Pipe Line Corp. as agent for the companies.

Status: Under way.

Contractor: **San Juan Engineering Co.**, Farmington; **E. H. Schmidt & Associates, Inc.**, Tulsa; **McIntire & Quiros, Inc.**, Los Angeles.

Completion: End 1957.

Fulton, R. H. & Co., Lubbock, Tex.

Project: 39 miles of 6-in. from Donkey Creek field in northeastern Wyoming, southeast to the Osage pump station in Weston County.

Status: Fulton, a contractor has applied to Wyoming Public Service Commission.

• **Interstate Oil Pipe Line Co.**

Project: 5 miles of 4-in. from South Bosco field, Louisiana, to present main line, and 5 miles of various size from Church Point field, Louisiana, to present main line.

Status: Proposed.

Magnolia Petroleum Co.

Project: 203 miles of 12, 16, and 20-in. loops between Midland and Beaumont, Tex.

Status: To start August 1957.

Contractor: **O. R. Burden Construction Corp.** has 121 miles of 16-in. and 5 miles of 12-in. between Midland and Corsicana. **H. B. Zachry Co.** has 77 miles of 12, 16, and 20-in. between Corsicana and Beaumont.

Completion: Early 1958.

• **Northwest Pipeline Corp.** (an affiliate of Pacific Northwest)

Project 80 miles of 8-in. and 300 miles of 10-in. crude and products line from Four Corners area to Salt Lake City.

Status: To start May 1957.

Completion: August 1957.

• **Offshore Gathering Corp.**, Houston.

Project: 364 miles of mostly 20-in. in Gulf of Mexico off Louisiana. (Dual line.)

Status: Proposed.

Pasotex Pipe Line Co.

Project: 127 miles of 20-in. along its route from Wink to El Paso, retiring another dual 8-in. section.

Status: Under way.

Contractor: **R. H. Fulton & Co.**

Completion: July 1, 1957.

• **Salt Lake Pipe Line Co.**

Project: 100 miles of 10-in. looping of Rangely, Colo., to Salt Lake City line.

Status: Pipe has been ordered.

Completion: Late 1957.

• **Shamrock Oil & Gas Corp.**

Project: 35 miles of 6-in. to serve fields in Ochiltree and Hansford counties in the Texas Panhandle.

Status: Under way.

Shell Oil Co.

Project: Undetermined length of 3, 4-in. in South Louisiana.

Status: Under way.

Contractor: **Brown & Root, Inc.**, W. P. Stanley, spread superintendent, office at Buras, La.

Completion: September 30, 1957.

• **Sinclair Pipeline Co.**

Project: 150 miles of 20-in. from Teague, Tex., to Houston.

Status: Planned for 1958.

Completion: 1958.

• **Skelly Oil Co.**

Project: 38 miles of 8-in. extension of its gathering system into southern Kiowa County, Kansas.

Status: Planned.

Completion: Early fall 1957.

• **Southern Kansas Pipeline, Inc.** (newly organized).

Project: 200 miles of 6 to 10-in. from southwestern Meade County to a point in Cowley County, 10 miles north of Arkansas City.

Status: Proposed. Request filed with Kansas Corporation Commission for permit.

• **Tecumseh Pipe Line System** (Joint venture of Sinclair Pipe Line, Ashland Oil & Refining, and Pure Oil Co.)

Project: 201 miles of 20-in. between Griffith, Ind., and Cygnet, Ohio.

Status: Under way.

Contractor: **O. R. Burden Construction Corp.** has two spreads of 93 miles from Griffith eastward and 92 miles from the mid-point to Cygnet. The 16 miles from Chicago to Griffith has not been let.

Completion: September 1957.

• **Texas-New Mexico Pipe Line Co.** (owned by The Texas Co., Sinclair Pipe Line Co., Tidewater Oil Co., and Empire Gas & Fuel Co.)

Project: 515 miles of 16-in. from southeast corner of Utah to Jal in southeastern New Mexico.

Status: Field surveys began January 1957.

Contractor: Survey contracts went to **J. V. McCoy**, Houston, and **E. H. Schmidt and Associates**, Tulsa.

Completion: 1958.

U.S. Products Pipelines

• **Alaska-Yukon Refiners & Distributors, Ltd.**

Project: Two lines: one 150 miles from Haines to Haines Junction, Alaska, linking with government Canol line; another from Tok Junction, on the Canol line, to Anchorage.

Status: Proposed.

Completion: 1959.

• **American Pipe Line Co.**

Project: Line from Gulf Coast to New York City area. Received ODM approval to amortize 40 per cent of $175,000,000 cost with a rapid writeoff.

Status: Proposed

Buckeye Pipe Line Co.

Project: Conversion of 116 miles of 8-in.

COATES Field Service, INC.
P. O. Box 1581 OKLA. CITY
Thoroughly Specialized
RIGHT-OF-WAY PROCUREMENT
From Title Search . . .
. . . To Damage Claims

The L-K (Melton)
HEATING HYDROMETER CYLINDER
Assures Correct Gravity Readings!

The L-K (Melton) unit is an improved type of Heating Hydrometer Cylinder. It furnishes a practical way of heating samples of waxy crudes so that hydrometers will float in them, and this insures correct gravity readings of such samples.

Pat. Pending

This unit has many advantages. It is explosion proof. It is of all aluminum construction and has a strip-type heating element which may easily be replaced in the field when necessary.

The unit has a thermostatically controlled heating range of approximately 50° to 240° F., and is furnished with removable Pyrex inner cylinder.

The cylinder can be furnished for 6 volts D.C., 12 volts D.C., or 115 volts A.C. Inside dimensions conform to API specifications.

Write, wire, or phone for additional information.

L-K PUMP VALVE CO.
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Completely Air-Conditioned
Centrally Located
Adjacent Garage

BUSINESS and PLEASURE in TULSA means . . .

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LD 381 TULSA'S world-famous HOTEL

Pipeline Patrol

crude to products between Huntington, Ind., and Griffith, Ind.
Status: Planned.
Contractor: **Sheehan Pipe Line Construction Co.,** C. M. Brown, superintendent, office at Rochester, Ind.
Completion: Fall 1957.
Project: Conversion of 32 miles of 8-in. crude to products between Mantua, Ohio, and Youngstown area.
Status: Planned.
Contractor: Company will do own work.
Completion: November 1957.

- **Cities Service Pipe Line Co.**
  Project: 29 miles of 6-in. ethylene line from Lake Charles, La., to Orange, Tex.
  Status: Planned.
  Completion: July 31, 1957.
  Project: 168 miles of 6-in. L.P.G. line from East Chicago, Ind., to Lowell, Mich.
  Status: To start June 1, 1957.
- **Continental Pipe Line Co.**
  Project: Conversion of 99 miles of 6-in. from the Wichita Falls area to near Fort Worth, Tex., plus a 15-mile extension of the line to the Grapevine area northeast of Fort Worth.
  Status: Conversion under way. Extension planned.
- **El Paso Natural Gas Co.**
  Project: 11 miles of 4-in. L.P.G. products from Snyder Line to South Andrews Plant, Texas.
  Status: Planned.
  Project: 240 miles of 6-in. from Odessa to El, Paso, Tex.
  Status: Planned.
  Contractor: **Pipeline Engineering Co.** has design and engineering contract.
  Completion: Early 1958.

Engineering Management, Inc.
Project: 58 miles of 10-in. from Richmond to Castle, Calif.
Status: Under way.
Contractor: **Hood Construction Co.,** William Burgess, spread superintendent, office at Sacramento.
Completion: July 1, 1957.

- **Great Lakes Pipe Line Co.**
  Project: 84 miles of 8-in. from south of St. Paul to Eau Claire, Wis.; 68 miles of 12-in. from Great Lakes intersecting point with Badger Pipe Line to Chicago.
  Status: Construction scheduled to start spring 1957.
  Project: 15 miles of 6-in. from Lincoln, Neb., to Lincoln air base.
  Project: 140 miles of 8-in. from Minneapolis to Superior terminals.
  Project: 34 miles of 12-in. from Tulsa to Barnsdall, Okla., to supplement existing 12 and 8-in. lines.
  Project: 14 miles of 8-in. from Coffeyville to Independence, Kan., to replace present 4-in line.
  Project: 11 miles of 8-in. from approximately 10 miles east of the Great Lakes pumping station at Donahue, Iowa, to terminals on the Mississippi River at Bettendorf, Iowa.
- **Gulf Refining Co.**
  Project: 530 miles of 10-in. L.P.G. and natural gasoline line from Waddell Plant in Crane County, Texas, to Mont Belvieu near Houston (368 miles is conversion from crude service).
  Status: Under way.
  Contractor: **Panama-Williams Corp.** has 46 miles from Waddell Plant to Midland. Remainder not let.
- **Laurel Pipeline Co.** (Gulf Refining Co. and Sinclair Pipe Line Co.)
  Project: A 24-in. line from the Philadelphia refining area to Cleveland.
  Status: Under consideration.

NEW! OBSTRUCTION LIGHTS
HIGH QUALITY — LIGHT WEIGHT
SIMPLE — POSITIVE LATCH
FOR EASIER MAINTENANCE
In accordance with CAA Spec. L-810
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— your most dependable source of Obstruction Lighting Equipment
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MODEL OB21 is of the SIDE ENTRANCE conduit fitting type in order to facilitate installation on horizontal conduit runs. Available in ¾" or 1" conduit tap

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MODEL OB22 DOUBLE LIGHT is available with or without CABLE SUPPORT — also available with TRANSFER RELAY. 1" conduit tap

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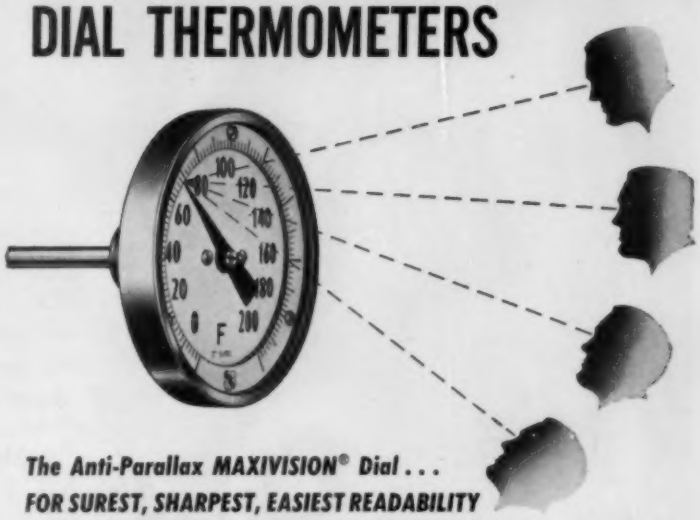
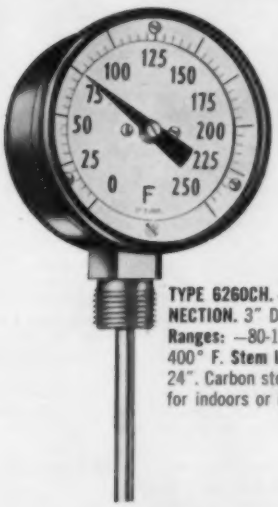
TYPE 6360AH. — BACK CONNECTION. 3" and 5" Dials. **Temperature Ranges:** —80-120° F. to +200-1000° F. **Stem Lengths:** 2½" to 24". Climate-proof stainless steel case.

GET ACCURATE "ON-THE-SPOT" TEMPERATURE READINGS...

INSTALL 'AMERICAN' BI-METAL DIAL THERMOMETERS





TYPE 6260CH. — BOTTOM CONNECTION. 3" Dial. **Temperature Ranges:** —80-120° F. to +50-400° F. **Stem Lengths:** 2½" to 24". Carbon steel case suitable for indoors or outdoors.

The Anti-Parallax MAXIVISION® Dial...
FOR SUREST, SHARPEST, EASIEST READABILITY
...Is Available Only In 'American' Thermometers

Nowadays fewer men are required in power and processing plants to inspect operations, so it is more important than ever to have observation points handy for them. 'American' Bi-Metal Dial Thermometers, installed at important check points, eliminate frequent trips to the control house. Inspectors can observe variations in process temperatures "on the spot" and take steps to effect corrections.

The economy of these thermometers goes far beyond the time-saving convenience of local indoor and outdoor readings. Their accuracy and utility contribute to lower costs. They provide the greatest sensitivity in bi-metal actuation. The low-mass single helix bi-metal coil is precisely centered in the stem to assure quick, accurate response to all temperature changes — to prevent the retard effect the coil can cause if rubbed against the stem wall.

The Maxivision dial is a split-level dial with pointer set on the same plane as the outside raised ring that carries the graduations. No perspective effect, no parallax! Readings are sure, sharp and accurate at a glance!

The availability of 'American' Bi-Metal Dial Thermometers in types with back, bottom or "Every Angle" connection permits selection to fit the conditions of each location. For example, the "Every Angle" type can be set at any point within 180° on two axes. Thus it is particularly recommended for installation above or below eye level or in close quarters where the types with fixed back or bottom connection would be impractical.

TYPE 6060AH. — "EVERY ANGLE" CONNECTION. 5" Dial. **Temperature Ranges:** —80-120° F. to +200-1000° F. **Stem Lengths:** 4" to 24". Climate-proof stainless steel case.

PHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR for assistance in selecting the types of 'American' Bi-Metal Dial Thermometer best suited to your needs. He can provide separable sockets in all materials and sizes normally required.

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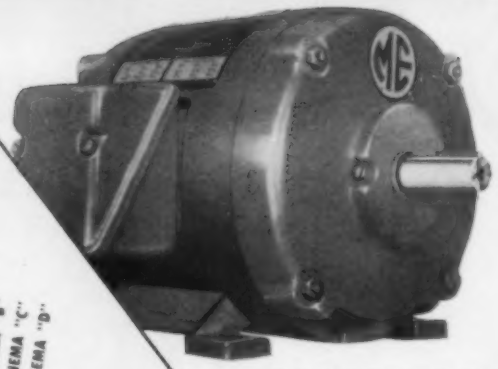
OILFIELD MOTORS



New NEMA Frames 182 thru 326U

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Designs:
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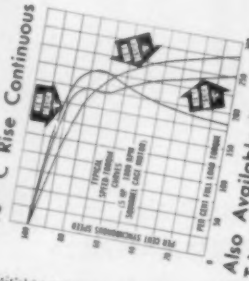

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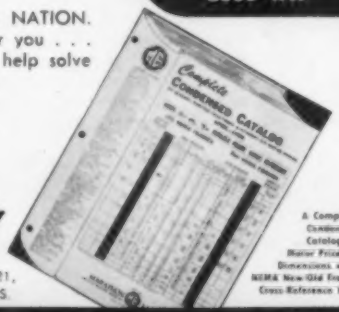

A Complete Condensed Catalog of Motor Prices & Dimensions with NEMA New-Old Frame Cross-Reference List

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MARATHON ELECTRIC

HOME OFFICE AND FACTORY, WAUSAU, WIS. FACTORIES AT ERIE, PA. AND EARLVILLE, ILL.

SALES OFFICES IN PRINCIPAL CITIES

Pipeline Patrol

- **Northwest Pipeline Corp.** (an affiliate of Pacific Northwest)
  Project: 80 miles of 8-in. and 300 miles of 10-in. products and crude line from Four Corners area to Salt Lake City.
  Status: To start May 1957.
  Completion: August 1957.
- **Ohio Oil Co.**
  Project: 350-miles of 12-in. from Wood River, Ill., to Chicago.
  Status: Work to start fall 1957.
  Completion: 1958.
- **Salt Lake Pipe Line Co.**
  Project: 80 miles of 8-in. looping of line from Boise, Idaho, to Pasco Wash.
  Status: Pipe has been ordered.
  Completion: Late 1957.
- **Southern Pacific Pipe Lines, Inc.**
  Project: 100 miles of 10-in., 80 miles of 8-in., and 125 miles of 6-in. between Richmond, Calif., and Fallon, Nev.
  Status: Under way.
  Contractor: **River Construction Corp.** has 84 miles of 8, 10-in. from Richmond to Stockton, Calif. to complete late spring 1957, F. O. Traweek, spread superintendent, office at Richmond. **Hood Construction Co.**, Lynwood, Calif., has 58 miles of 10-in. from Stockton to Roseville, Calif. **Engineers, Limited Pipeline Co.** and **Joe E. Young Pipe Line Construction Co.** have 18 miles of 6 and 8-in. between Roseville and Donner Summit.
  Completion: August 1, 1957.

Trust Pipe Line Co. (Cosden Petroleum)
Project: 128 miles of 6-in. from Hawley, near Abilene, to Wichita Falls, Tex.
Status: To start July 1957.
Contractor: **Pipe Line Technologists, Inc.**, has the design and engineering.
Completion: October 1957.

- **Union Oil Co. of California**
  Project: 815-mile line from Rifle, Colo., to Los Angeles refining area, to carry products from its proposed Rifle shale-oil plant.
  Status: Proposed.

Yellowstone Pipe Line Co.
Project: 25 miles of 8-in. in the Spokane, Wash., area to deliver jet fuel to Geiger and Fairchild Air Force bases.
Status: Under way.
Contractor: **Engineers, Ltd., Pipeline Co.**
Completion: May 15, 1957.

U.S. Natural-Gas Pipelines

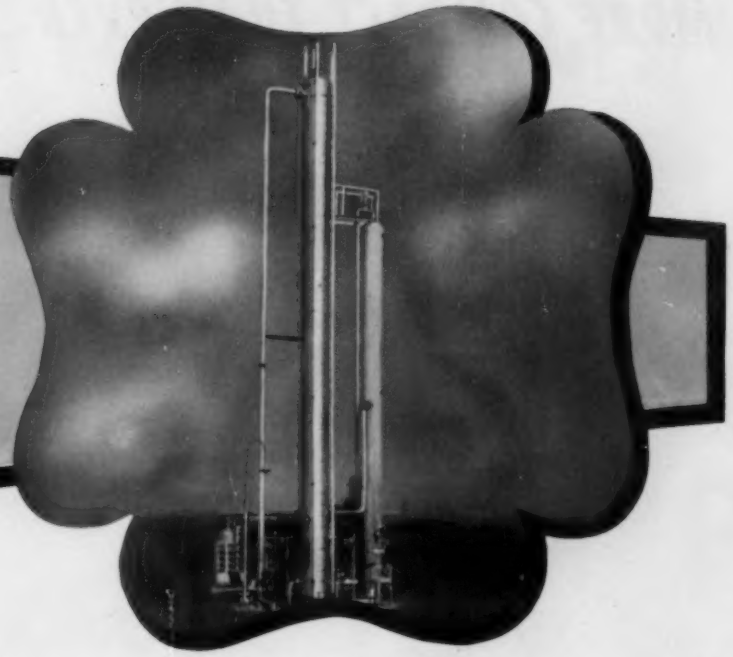
- **American Louisiana Pipe Line Co.**
  Project: 7 miles of 16-in. and 5 miles of 12-in. at North Holly Beach Field and Second Bayou Field, Cameron Parish, La.
  Status: Has temporary FPC permit.
- **Arkansas Louisiana Gas Co.**
  Project: A 300-mile line from Texas-Louisiana coastal region to northern Louisiana, to connect with their present system, plus gathering lines.
  Status: Long-range plans.

Carolina Pipeline Co.
Project: 177 miles of 2, 3, 4, 6, 8, and 10-in. between Blacksburg and Camden. S. C.
Status: Work to start June 1, 1957.
Contractor: **Panama-Williams Corp.**

- **Central Hudson Gas & Electric Corp.**
  Project: 46 miles of 10-in. from Albany to Kingston, N. Y.
  Status: Planned.
  Completion: November 1, 1957.

Cities Service Gas Co.
Project: 8 miles of 16-in., 20 miles of 8-in., 20 miles of 6-in., and 20 miles of 4-in. field lines in Barber County, Kansas.
Status: Approved. Under way.
Contractor: **Vaughn & Taylor Construction Co.**
Project: 3 miles of 12-in., 8 miles of 10-in., 4 miles of 8-in., 8 miles of 6-in., and 37 miles

McNAMAR



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The McNamar portable gasoline plant is designed to control the hydrocarbon content of sales gas and to economically recover natural gasoline and LPG.

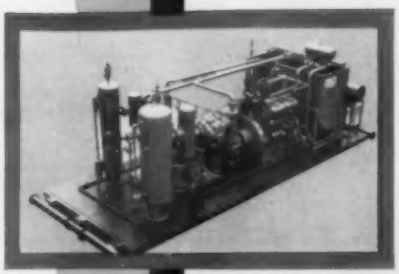
The plants are also designed to fractionate the distillate, if desired. The ease of moving from one location to another, the simplicity in design, and the dependable operation of this unit are factors that greatly reduce operating and maintenance costs.

The usage of the McNamar portable gasoline plant is extremely flexible. The unit can be completely operated automatically, saving time and costs.

For dependable, economical gas plant operation, you can be assured of complete satisfaction when you purchase McNamar quality equipment.

Call, write or wire McNamar for further information.

De-Sulphurization Plants • Glycol and Solid Dessicant Units



The McNamar Joy WNB 112, 200 horsepower, twin cylinder Gas Compressor features compactness, portability and versatility. The units are completely packaged, easily installed and economical to operate.

The McNamar Joy-Gas Compressor units may be engineered to your application and are available on purchase, rental and rental-purchase option basis. 50, 100, 300 and 400 horsepower sizes also available.

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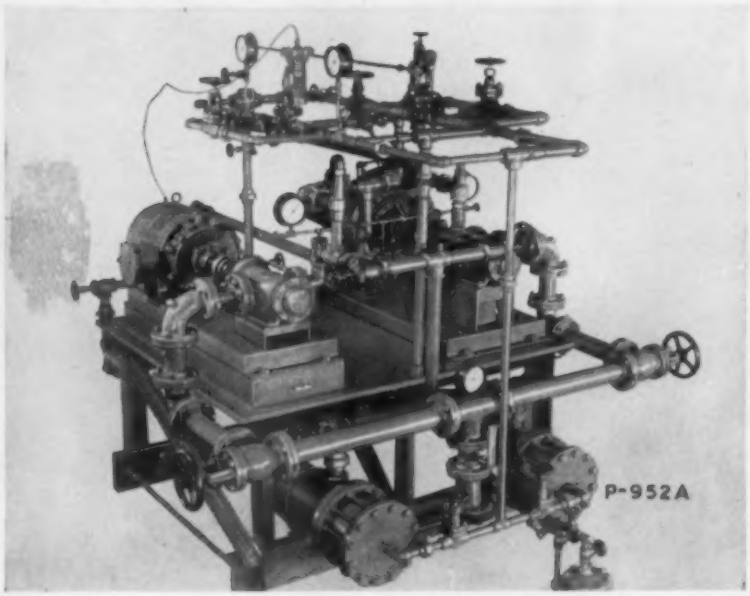
COMPLETE RANGE OF SIZES AND MODELS IN BOTH MEDIUM AND HIGH PRESSURE TYPES

MORE COMPACT THAN EVER . .



P-952A—Steam Turbine and Electric Motor drive gives flexibility in this compact Model P-ES2H size No. 25 unit.

NATIONAL AIROIL

FUEL OIL PUMPING *AND* HEATING UNITS

NATIONAL AIROIL Fuel Oil Pumping and Heating Units are specially designed to prepare, for combustion, all grades of fuel oil including No. 6 or Bunker "C" Oil and residuums. They will draw fuel oil from above ground or underground tanks, preheat it to proper constant temperature and deliver it to Oil Burners at an even pressure, best suited for the burners. Our Fuel Oil Pumping and Heating Units are the result of years of experience. They come completely equipped ready for steam, exhaust, condensate, oil suction, oil return and electrical connections. All valves, regulators, etc., are readily accessible. The piping arrangement is easily understood. These compact, space-saving units are available in a range of sizes and models in both Medium and High Pressure types. For complete details, write for our Bulletin 40—very interesting and informative.

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Southwestern Division: 2512 South Boulevard, Houston 6, Texas

Pipeline Patrol

of 4-in. field lines in Eureka Field, Okla.
Status: Approved. Under way.
Contractor: **Vaughn & Taylor Construction Co.**
Project: 4 miles of 16-in. at Sarcoxie, Mo.
Status: Approved. Under way.
Contractor: **Prairie Construction Co.**
Project. 64 miles of 6 to 30-in. in Leavenworth and Anderson counties, Kansas, Cass County, Missouri. and Oklahoma County, Oklahoma.
Status: Planned.

• **Coastal Transmission Corp.**
Project: 575 miles of 12, 20, 22, 24-in. main line and 414 miles of 2 to 14-in. gathering lines between McAllen, Tex., and Baton Rouge, La.
Status: Has FPC approval.
Completion: **January 1, 1958.**

• **Colonial Natural Gas Corp.**
Project: Two systems; one between Houston-Lake Charles area and Miami, Fla.; one in the Carolinas and Georgia.
Status: Proposed.

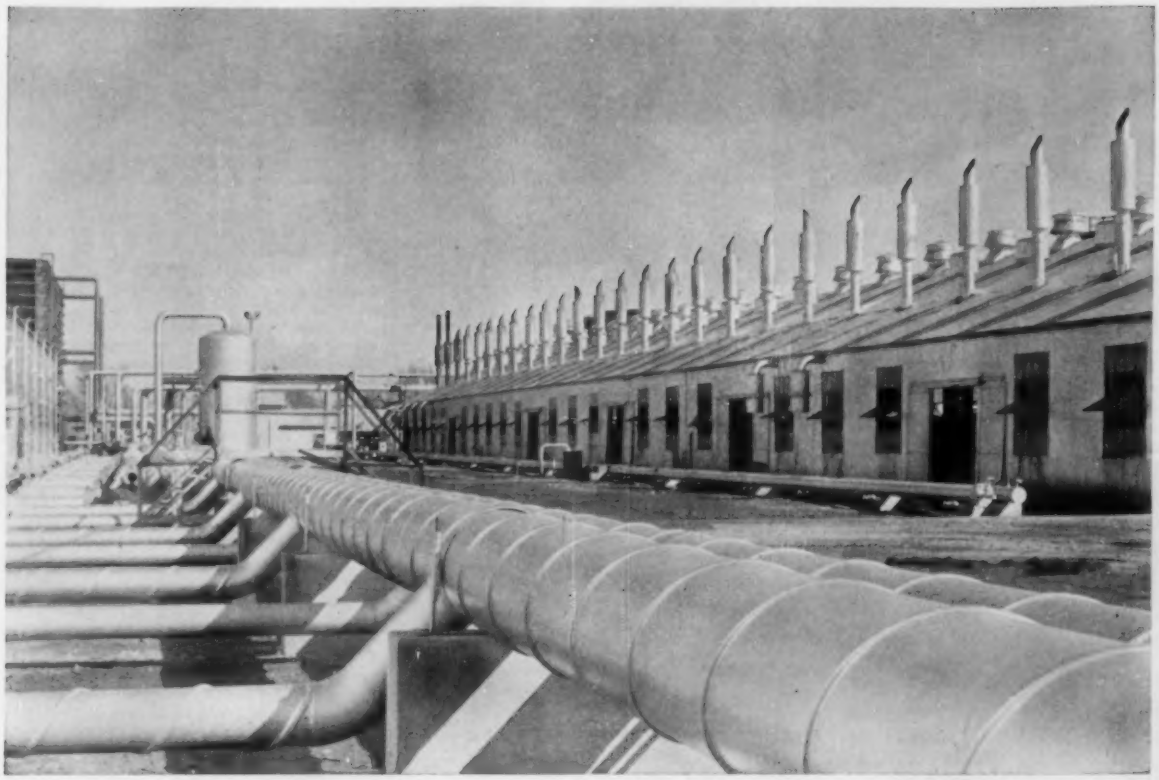
• **Colorado Interstate Gas Co.**
Project: 1957 program . . . 66 miles of 30-in., 40 miles of 34-in., 109 miles of 26-in., and 100 miles of 24-in. from Springfield, Colo., to Pueblo, Colo; 345 miles of 30-in. from Kit Carson, Colo., to Beatrice, Neb.; 30 miles of 22-in. from Laverne to Hooker. Okla.; 24 miles of 22-in. Panhandle field looping.
Status: Pending FPC approval.
Project: 139 miles of 4 to 24-in. from Mocane to Hooker, Okla.
Status: Under way.
Contractor: **Panama, Inc.** Spread offices will be at Beaver City and at Mocane, Okla.
Completion: May 15, 1957.

• **Eastern Shore Natural Gas Co.**
Project: 34 miles of 8-in. and 90 miles of 6-in. from connection with Transcontinental Gas Pipe Line Corp. in Maryland, across entire length of Delaware to Salisbury.
Status: Pending FPC approval.

• **El Paso Natural Gas Co.**
Project: 74 miles of 34-in. San Juan main line loops.
Status: Planned. Filed for FPC permit.
Completion: August 1957.
Project: 94 miles of 18-in. from Panoma Plant, Gray County, to Dumas Plant, Moore County, Texas.
Status: To start May 1957.
Contractor: **R. H. Fulton & Co.**
Completion: July 1957.
Project: 177 miles of 20-in. from Sonora Plant, Sutton County, to Plains Plant, Yoakum County, Texas.
Status: Planned. Filed for FPC permit.
Completion: January 1958.
Project: 74 miles of 30-in. Permian-San Juan main line loops.
Status: Planned. Filed for FPC permit.
Completion: January 1958.
Project: 216 miles of 6 to 34-in. in Arizona, Texas, and New Mexico, plus 533 miles of various size line.
Status: Filed for FPC permit.
Project: 47 miles of 30-in. from proposed Lindrith, N. M., plant to proposed Chaco, N. M., plant.
Status: To start May 1957.
Contractor: **Foutz & Bursum Construction Co.**
Completion: 1957.

Houston Texas Gas & Oil Corp.
Project: 702 miles of 24-in. from Baton Rouge, La., to Kissimmee, Fla.; 240 miles of 18-in. from Kissimmee to Cutler, Fla.; 642 miles of 3 to 18-in. sales laterals in Florida. Main line to join Coastal Transmission's proposed line from McAllen, Tex., to Baton Rouge.

STEEL "FREEWAY" TO FIELD PROCESSING



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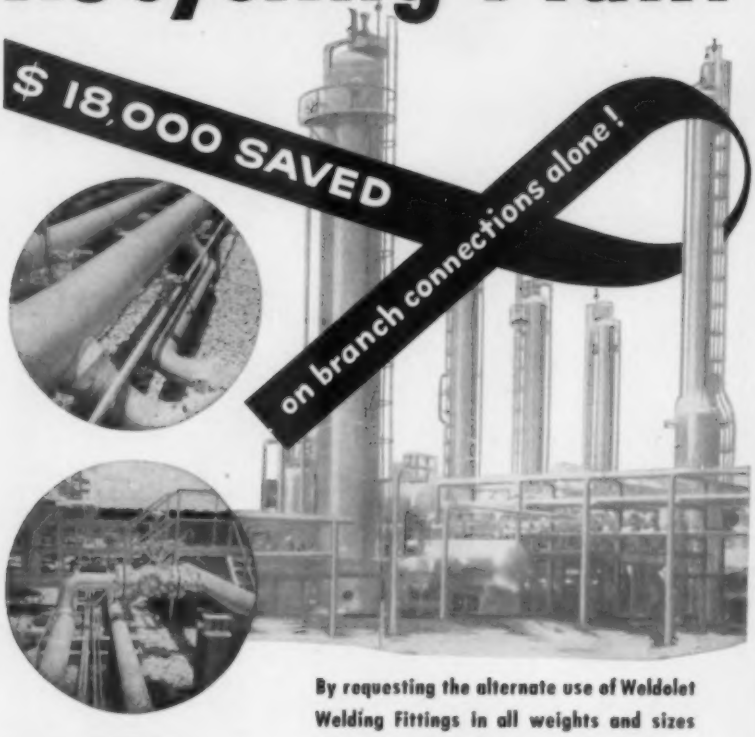

By requesting the alternate use of Weldolet Welding Fittings in all weights and sizes the piping contractor was able to lower his bid sufficiently to be awarded the job!

This recently completed recycling plant in Louisiana was designed and engineered in full accordance with the ASA and ASME Codes and operates at a maximum pressure of 4500 psi and 225°.

The piping engineers on this job were confronted with a number of tough problems. The plant was to be operated at extremely high pressures. The terrain was swampy which meant the fittings had to withstand the additional stresses exerted by a settling foundation. The piping also had to stand up under rugged vibration conditions. The many design features of Weldolet Welding Fittings in both full size and reducing size outlets provided the safe, practical and most economical answer to these knotty service problems.

WELDING FITTINGS DIVISION

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Pipeline Patrol

Status: Planned. FPC certificated.

Contractor: **Midwestern Constructors** has the 702 miles of 24-in.; **Harbert Construction Corp.** has remainder.

Completion: June 1958.

- **Iron Ranges Natural Gas Co.,** St. Paul.

Project: 68-mile transmission line and 47 miles of laterals to supply towns on the Mesabi Iron Range, Minn.

Status: Application pending with FPC.

- **Kansas-Nebraska Natural Gas Co.**

Project: 61 miles of various size gathering line in Camerick field, Texas County, Oklahoma.

Status: Approved.

Michigan Consolidated Gas Co.

Project: 67 miles of 10 and 12-in. between Sears and Travers City, Mich.

Status: Under way.

Contractor: **Somerville Construction Co.;** Floyd Huduall, spread superintendent, office at Cadillac, Mich.

Project: 60 miles of 10 and 12-in. between Muskegon and Ludington, Mich.

Status: Under way.

Contractor: **Somerville Construction Co.,** jointly with **J. L. Gentry Construction;** Frank Morris, spread superintendent, office at Hart, Mich.

- **Michigan Wisconsin Pipe Line Co.**

Project: 24 miles of 24-in. and 18 miles of various size looping in Michigan, Indiana, Illinois, Wisconsin, Iowa, and Missouri.

Status: Approved.

Completion: October 1, 1957.

- **Midwestern Gas Transmission Co.**

Project: Will build main line from Portland, Tenn., to Canadian border near Emerson, Man.; 829 miles of 24-in., 109 miles of 16-in., 174 miles of 12-in., 648 miles of 3 to 18-in. extensions in Minnesota and Wisconsin.

Status: Application pending with FPC.

- **Mississippi River Fuel Corp.**

Project: 125 miles of loops along portions of present lines from fields in Louisiana and eastern Texas, to St. Louis.

Status: Planned.

- **Mountain Fuel Supply Co.,** Salt Lake City

Project: 38 miles of line to connect with Pacific Northwest Pipeline Corp.'s system in Sweetwater County, Wyoming.

Status: Has temporary FPC permit.

- **Natural Gas Pipeline Co. of America**

Project: 350 miles of 20 and 26-in. from Jack and Wise counties, Texas, to Fritch, Tex., plus a gathering system.

Status: Under way.

Contractor: **R. H. Fulton & Co.** has Red River crossing in northern Montague County. **Fulton & Brodie, Inc.,** Lubbock, Tex., has gathering system.

Completion: Total project to be completed by January 1, 1958.

Project: 389 miles of 36-in. loops along its line from Beatrice, Neb., to Chicago, to take gas from proposed line of Colorado Interstate Gas Co., and for 91 miles of 30-in. loops along parts of its main line.

Status: Application pending with FPC.

Project: 337 miles of 30-in. between Fritch, Tex., and Beatrice, Neb., and 59 miles of 36-in. between Beatrice and Joilet, Ill., along Natural's existing system from the Texas Panhandle to Chicago.

Status: Pending FPC approval.

Completion: 1959.

- **New York State Natural Gas Corp.**

Project: 15 miles of 30-in. from Horseheads to Newfield, N. Y.; 31 miles of 20-in. from Harrison to Woodhull, N. Y.; 10 miles of 12-in. from Stockbridge to Oneida, N. Y.

Status: Planned.

- **Niagara Mohawk Power Corp.**

STEWART & STEVENSON...FIRST TO PRESENT A NEW MODEL 6-110 GENERAL MOTORS QUAD APPLICATION

- Hydraulic actuated disconnect clutches. Power may be taken off either end of the 6-110 Quad. A dual power takeoff arrangement is also available.
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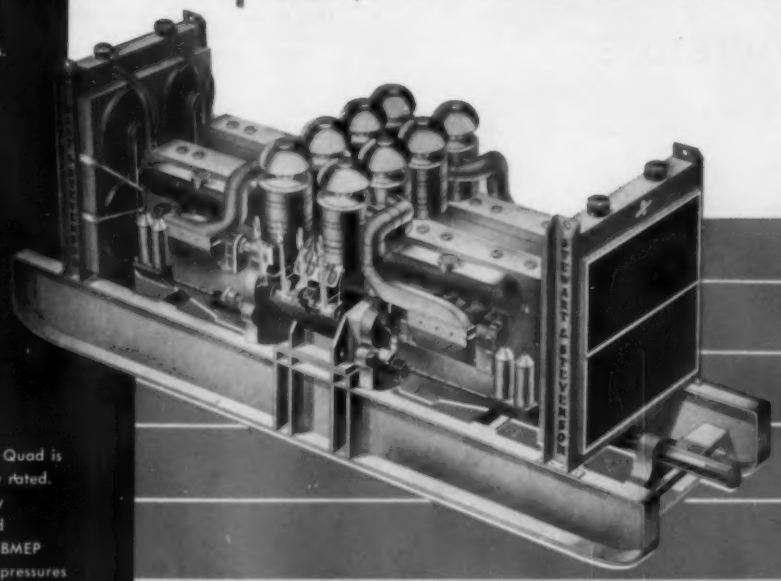
It packs a 1000 H.P. WALLOP!

6-110 QUAD



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Several years ago, Stewart & Stevenson introduced the Series 6-71 Quad to the oil industry. No other engine unit has ever matched it for service. Now, here is a new, higher horsepower 6-110 Quad with the same characteristics for dependability and performance of the earlier model, *yet with 55% more horsepower.*

The new GM 6-110 Quad by Stewart & Stevenson utilizes approximately 98% standard GM Diesel Engine parts in both the gear and engine applications. It uses tandem twin gear parts in a newly designed and ruggedly built case of welded steel construction, designed especially for the 6-110 Quad application.

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Pipeline Patrol

Project: 14 miles of 18-in. from Phoenix to Palermo, N. Y.
Status: Planned.
Completion: October 1, 1957.
Project: 261 miles of 2 to 16-in. transmission and distribution mains to service areas in central, eastern and northern New York state.
Status: Planned.
Contractor: Various.
Completion: December 31, 1957.

- **North Carolina Natural Gas Corp. (Subsidary of Colonial Natural Gas Corp.)**

Project: 630 miles of 2 to 16-in. from Transcontinental Gas Pipe Line Corp.'s system near Mooresville, eastwardly across north Carolina.
Status: To start fall 1957.
Completion: Spring 1958.

- **Northern Natural Gas Co.**

Project: 160 miles of 2, 3, 6, 8-in. branch lines to serve 20 new communities on Aberdeen, S. D., line.
Status: Under way.
Contractor: **Troth Construction Co.**
Project: 73 miles of 20-in. from Savana Creek to Pincher Creek fields in Alberta, Canada; 32 miles of 24-in. from Pincher Creek to Montana border; 1,100 miles of 26-in. from Montana into Minneapolis.
Status: Planned.
Project: 365 miles of main line and 1,090 miles of branch lines to serve communities in Minnesota, Iowa, South Dakota, Nebraska, and Wisconsin.
Status: Filed with FPC March 18, 1957.

- **Offshore Gathering Corp.**, Houston.

Project: 364 miles in Gulf of Mexico off Louisiana.; 60 miles of 24-in., 70 miles of 26-in., 234 miles of 30-in. (Dual line.)
Status: Application pending with FPC.

- **Ohio Fuel Gas Co.**

Project: 7 miles of 12-in. near Fremont, Ohio.
Status: Planned.
Completion: First half 1957.
Project: 23 miles of 18, 20-in. from Gibsonburg to Toledo.
Status: Uncertain.
Project: 152 miles of line in Ohio: 38 miles of 24-in. from Crawford Station to Utica; 18 miles of 24-in. from Pavonia Station to Line D; 6 miles of 20-in. from Mount Gilead to Claridon; 4 miles of 20-in. near Dayton; 4 miles of 20-in. near South Charleston; 7 miles of 16-in. near Springfield; 6 miles of 20-in. nnear Oberlin; 17 miles of 20-in. from Oak Hill to Symmes Station; 7 miles of 12-in. from Mount Sterling to Bloomingburg; 2 miles of 8-in. near Bellefontaine; 3 miles of 12-in. near Mansfield; 4 miles of 12-in. near Lakeville; 7 miles of 8-in. in Guernsey and Belmont counties.
Status: Planned.
Completion: Second half 1957.

- **Pacific Gas & Electric Co.**

Project: 37 miles of 20-in., 37 miles of 18-in., 3 miles of 16-in. from Beehive Bend field near Willows, Calif., to near Davis, then to Sacramento.
Status: Under way.
Contractor: **Engineers Limited Pipeline Co.**
Completion: June 1957.
Project: 138 miles of 34-in. looping of the Topock-Milpitas line.
Status: Planned.
Completion: December 1, 1957.
Project: 5 miles of 16-in., 160 miles of 12-in., 8 miles of 6-in. from Corning to Eureka, Calif., to connect company's Humboldt Division with integrated gas system.
Status: Planned.
Completion: January 1958.
Project: 13 miles of 12-in., 2 miles of 10-in.. from Santa Cruz to Davenport, Calif.

Pipeline Patrol

Status: Planned.
Completion: October 1957.

• **Pacific Northwest Pipeline Corp.**
Project: 37 miles of 6-in. from Dove Creek to Nucla, Colo., and 13 miles of 4-in. from Nucla to Urvan, to serve Union Carbide Nuclear Co. and Vanadium Corp. of America.
Status: Has FPC permit.
Project: 1,000 miles of gathering lines and laterals along present line.
Status: Planned.
Completion: 1957.

• **Pennsylvania Gas Co.**
Project: 23 miles of 10-in. in Erie County, Pa., 15 miles of 8-in. in Warren and Chautauqua counties, Pennsylvania, 30 miles of branch lines and a number of small distribution systems.
Status: Has FPC permit.

• **Peoples Natural Gas Co.**
Project: 58 miles of 2 to 14-in. extension and replacement lines in Pennsylvania.
Status: Work to start April 1957.
Completion: September 1957.

• **Permian Basin Pipeline Co.**
Project: 83 miles of 16-in. from its Spraberry station in Midland County, Texas, to tie in with Pioneer Gathering System, Inc., at a point in northwestern Schleicher County, Texas.
Status: Filed for FPC approval.

• **Phillips Petroleum Co.**
Project: 3 miles of 24-in. in Moore County, Texas.
Status: Planned.
Completion: October 1, 1957.
Project: 30 miles of 3 to 8-in. in Moore, Hutchinson, Sherman, Hansford, and Gray counties, Texas, and in Texas County, Oklahoma.
Status: Planned.
Contractor: Various.
Completion: January 1, 1958.

• **Piedmont Gas Co., Hickory, N. C. (Parent is Carolina Natural Gas Corp.)**
Project: 78 miles of 2 to 8-in. extension off Trancontinental in North Carolina to serve Gaston, Lincoln, Catawba, Caldwell, and Burke counties.
Status: Application pending with FPC.

• **Pioneer Gathering System, Inc.**
Project: 27 miles of 16-in. and 27 miles of 12-in. in Schleicher and Sutton counties, Texas.
Status: Filed for FPC approval.
Completion: July or August 1957.

Signal Oil & Gas Co.
Project: 80 miles of gathering lines serving Tioga, N. D., gasoline plant; system being extended to Antelope, North Blue Buttes, and South Blue Buttes fields, McKenzie County, North Dakota.
Status: Under way.
Contractor: **C. P. Bartley & Son**, Tioga, N. D.
Completion: October 1, 1957.

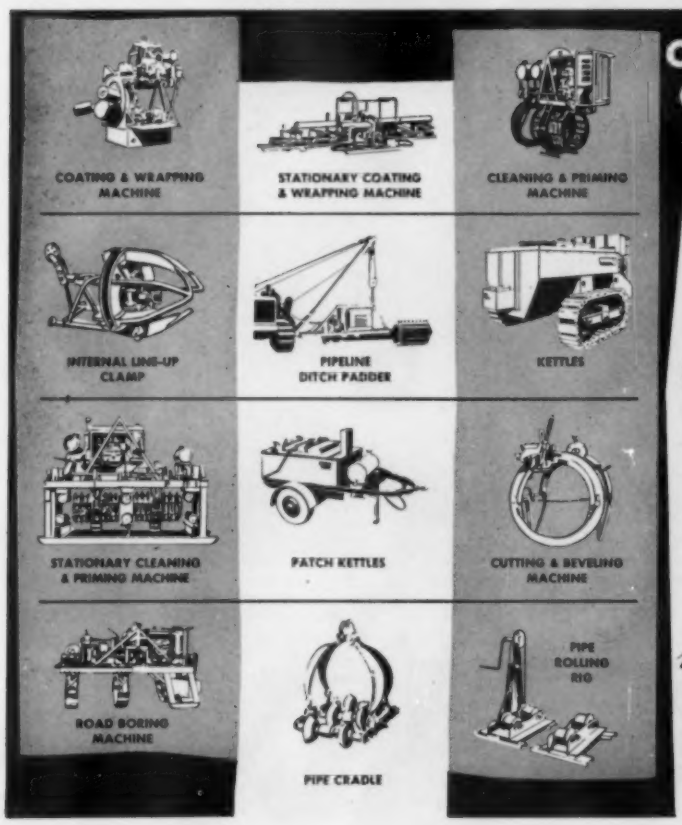
Southern California Edison Co.
Project: 200-mile line from San Joaquin Valley gas fields to power plant at Redondo Beach, Calif.
Status: Under way.
Completion: 1957.

Southern California Gas Co. and Southern Counties Gas Co. of California.
Project: 241 miles of 30-in. from the outskirts of Los Angeles to Topock on the Arizona-California border.
Status: Under way.
Contractor: **R. H. Fulton & Co.**
Completion: June 30, 1957.
Project: 4 miles of 30-in. from Los Angeles River to Victoria Station at Los Angeles.
Status: Planned.
Completion: July 30, 1957.

• **Southern Natural Gas Co.**
Project: 10 miles of 8-in. laterals in Napoleonville Field and Fort Jackson Field, La.
Status: Has FPC approval.
Completion: December 1, 1957.
Project: 32 miles of 6-in. from Chandeleur Sound area, Breton Island, La.; 7 miles of 8-in. and 5 miles of 10-in. from Main Pass area to Olga, La.; 9 miles of 8-in. from Bastian Bay Field to Fort Jackson Field; 7 miles of 8-in. laterals in Manila Village Field.
Status: Plan to apply for FPC permit.
Completion: December 1, 1957.

Spokane Natural Gas Co.
Project: 400 miles of 1 through 24-in. distribution system at Spokane.
Status: Under way.
Contractor: **Hallmac Construction Co.**; V. L. Williams, spread superintendent, office at Spokane.
Completion: 1957.

• **Tennessee Gas Transmission Co.**
Project: 221 miles of 30-in., 101 miles of 26-in., and 10 miles of 24-in. looping from Portland, Tenn., to Greenup, Ky.; from Morehead, Ky., to Catlettsburg, Ky.; from Catlettsburg to Broad Run, W. Va.; from New Wilmington, Pa., to Mercer, Pa.; and from New Castle, Pa., to near Pittsburgh, Pa.
Status: Pending FPC approval.
Project: 51 miles of 26-in., 51 miles of 20-in., and 17 miles of 12-in. gathering lines from Kinder, La., to offshore fields in Gulf of Mexico.
Status: Pending FPC approval.
Project: 577 miles of 30-in. from Mississippi River delta area south of New Orleans to Portland, Tenn.
Status: Pending FPC approval.



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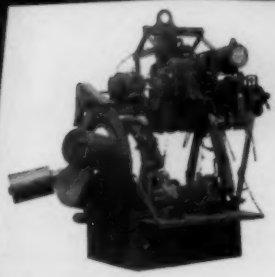

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Pipeline Patrol

Project: 76 miles of 24-in. between Coudersport, Pa., and Hamburg, N. Y.

Status: Pending FPC approval.

• **Texas Eastern Transmission Corp.**

Project: 422 miles of 30-in. from near McAllen to Beaumont, Tex., to move imported Mexican gas; 45 miles of 24-in. laterals from McAllen to Provident City, Tex., 77 miles of 30-in. looping between Kosciusko, Miss., and Uniontown, Pa.; 147 miles of supply and sales laterals.

Status: Under way.

Contractor: **Houston Contracting Co.** has 121 miles of 30-in. between Angleton and Vidor, Tex. **H. C. Price Co.** has 70 miles of 30-in. **H. B. Zachry Co.** has 201 miles of 30-in. starting near McAllen and running northeast to near Angleton, Tex. **Grayco Constructors, Inc.** has 45 miles of 24-in. laterals from Blessing to Provident City. **Western Pipe Line, Inc.,** Austin, has 30-in. crossings at Nueces, Lavaca, and Carancahua bays. **Missouri Valley Dredging Co.,** Omaha, has crossings at Hinds and Guadalupe bays. **Altgelt Construction Co., Inc.,** has 100 miles of 3, 4, 6, 8-in. gathering lines in the Corpus Christi area.

Project: 17 miles of 8-in. and 3 miles of 6-in. from its 20-in. Baytown-Hankamer line to Alco-Mag field in Harris County, Texas.

Status: Has FPC approval.

Project: 97 miles of 30-in. loops between Kosciusko, Miss., and Uniontown, Pa., and 40 miles of new lateral supply lines.

Status: Filed for FPC permit March 15. 1957.

Completion: September 1, 1957.

Project: 667 miles of 30-in. from Kosciusko, Miss., to Uniontown, Pa.

Contractors: **H. C. Price Co.** has 64 miles from Barton, Ala., to Mt. Pleasant, Tenn., 51 miles from Mt. Pleasant to Gladevile, Tenn., 52 miles from Gladeville to Tompkinsville, Ky., 68 miles from Tompkinsville to Danville, Ky., 63 miles from Danville to Owingsville, 46 miles from Owingsville to Wheelersburg, Ohio. (Four spreads will be used). **Williams Brothers Co.** has 63 miles from Egypt, Miss., to Barton, Ala., 64 miles from Berne, Ohio, to Uniontown, Pa. **Houston Contracting Co.** has 80 miles from Kosciusko, Miss., to Egypt, Miss., 57 miles from Wheelersburg to Athens, Ohio, 61 miles from Athens to Berne, Ohio.

Completion: Fall 1957.

• **Texas Illinois Natural Gas Pipeline Co.**

Project: 10 miles of 36-in. to loop existing single 30-in. near Joliet, Ill.

Status: Has FPC approval.

• **Transcontinental Gas Pipe Line Corp.**

Project: 172 miles of 36-in., 68 miles of 30-in., 162 miles of 24-in., and 64 miles of smaller diameter pipe to loop main line from Texas to New Jersey.

Status: Work in North Carolina to start late May 1957.

Contractor: **Western Construction Co.** has 65 miles of 36-in. and 45 miles of 30-in. at scattered spots along the system in South Carolina, North Carolina, Pennsylvania, and Virginia. Western will start work in North Carolina, spread office at Winston-Salem.

Completion: Total project to be completed December 1957.

• **United Gas Pipe Line Co.**

Project: 40 miles of 8-in. from Baldwin County, Alabama, to Container Corp.'s plant.

Status: Has FPC permit.

Canadian Crude-Oil Pipelines

• **B-A Alberta Pipe Line, Ltd.**

Project: 35 miles of 8-in. to connect Drumheller field, Alberta, with existing lines running to Edmonton.

Status: Pending approval

Interprovincial Pipe Line Co.

Project: 156 miles of 20-in. to extend present line from Sarnia to Port Credit, Ont.

Status: To start May 1957.

Contractor: **Somerville Construction Co.** has 90 miles; **Majestic Contractors, Ltd.,** has 66 miles.

Completion: September 1, 1957.

Project: 33 miles of 24-in. from Kendal to Peebles, Sask.

Status: To start June 1, 1957.

Contractor: **Fulton Banister, Ltd.,** John O'Rourke, superintendent.

Completion: July 31, 1957.

Project: 79 miles of 26-in. from Clearbrook, Minn., to Superior, Wis.

Status: To start June 1, 1957.

Contractor: **R. H. Fulton & Co.**

Completion: August 31, 1957.

Pembina Pipe Line, Ltd.

Project: 100 miles of 3 to 12-in. gathering line in Pembina oil field.

Contractor: **Universal Pipe Line, Ltd.,** subsidiary of Mannix, Ltd., T. Childress, spread superintendent, office at Drayton Valley, Alta.

Completion: November 1, 1957.

Project: 32 miles of 16-in. from Calmar to Edmonton, Alta.

Status: Under way.

Contractor: **Universal Pipe Lines, Ltd.,** subsidiary of Mannix, Ltd., Otis Hare, spread superintendent, office at Calgary, Alta.

Completion: July 1, 1957.

Rangeland Pipe Line Co.

Project: 48 miles of 12-in. between Sundre and the Sylvan Lake in south-central Alberta.

Status: Under way.

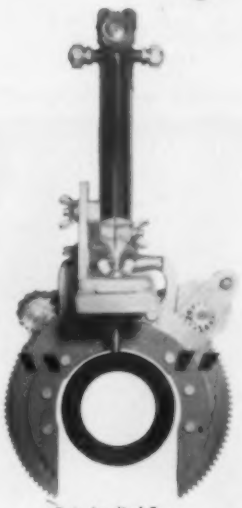
Contractor: **Dutton-Williams Brothers, Ltd.**

Completion: August 1957.

• **Royalite Oil Co., Ltd.**

Project: 250 miles of line to move oil from

model "O" for small diameter pipe cutting and beveling



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"Our emulsion treater valve diaphragms virtually never fail since we switched to neoprene," says Mr. A. I. Sellars, Chief Engineer, Maloney-Crawford Tank & Manufacturing Co., Tulsa.

Diaphragms in the valves of emulsion treaters take a beating chemically and physically. They are constantly exposed to oil, salt water and sulfur-laden gases at temperatures up to 170° F. And they must open and close continually as the well pumps. Once this meant trouble for Maloney-Crawford, makers of emulsion treaters.

"We tried several diaphragms of oil-resistant rubbers," reports Mr. Sellars. "They seemed to get hard and fail in a month or so. We did a brisk, and rather costly, replacement business much to our sorrow. Then we started using neoprene. In a year, our replacements fell off to nearly nothing."

Rugged neoprene—Du Pont's synthetic rubber—has a wide range of use in oil field equipment because it can take this kind of punishment. It resists sunlight, weathering and aging . . . oil and grease . . . abrasion and flex cracking—just about everything encountered in oil patches. So when you buy oil field rubber products be sure to specify the rubber with long, trouble-free service life: Du Pont neoprene.

This used to be common. Mr. Sellars shows how previous diaphragms, made of other synthetic rubbers, used to harden and fail—usually in about one month. Since neoprene diaphragms were substituted, "replacements have fallen off to nearly nothing."

NEOPRENE

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Here are a few of the many functions Mercoid Controls perform in safeguarding major pipeline equipment:

- *High discharge pressure*
- *High case pressure*
- *Low suction pressure*
- *High case temperature*
- *High bearing temperature*
- *Lube oil pressure*
- *Instrument air pressure*
- *Mechanical seal failure*
- *Differential pressure for pressurized control rooms*

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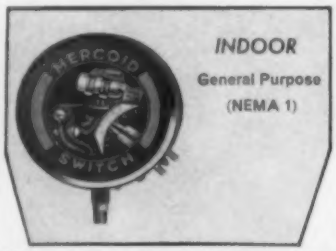

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NEMA 7, 9, 9A)

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THE MERCOID CORPORATION
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Pipeline Patrol

the Athabasca oil sands of northeastern Alberta to Edmonton.

Status: Long range plans.

Completion: 1960.

• **Trans Mountain Oil Pipe Line Co.**

Project: 100 miles of 30-in. loops: 50 miles east of Kamloops, B. C., and 50 miles west of Edson, Alta.

Status: Under way.

Contractor: **Marine Pipeline & Dredging, Ltd.**, has Thompson River crossing, B. C., J. H. McCartney, spread superintendent, office at Kamloops, B. C. **R. A. Conyes Construction Co.** has the 50 miles east of Kamloops; **Dutton-Williams Brothers, Ltd.** has the other 50 miles.

Completion: River crossing will be done by June 15, 1957; remainder by July 31, 1957.

• **Westspur Pipe Line Co.**

Project: 20 miles of 12-in. from Alida in southeastern Saskatchewan, to the Carnduff-Glen Ewen area to tap Cantal, Hastings, Florence, Carnduff, and Glen-Ewen fields; 14 miles of 4, 6, 8-in. gathering lines.

Status: Planned. Has requested permit from Board of Transport Commissioners.

Project: 75 miles of 16-in. from Steelman, Sask., to Cramer, Man., Canada.

Status: Work starts May 1957.

Completion: July 30, 1957.

Canadian Products Pipelines

Hydrocarbons Pipeline Co. (Subsidiary of Canadian Hydrocarbons)

Project: 800 miles of 6 and 8-in. L.P.G line from near Edmonton, Alta., to Fort William, Ont.

Status: Has permit from Parliament of Canada. If approved by Federal Board of Transport Commissioners and the Alberta Petroleum and Natural Gas Conservation Board, work will start early 1957.

Construction consultants: **Dutton-Williams Brothers, Ltd.**, Calgary, and **A. D. Little & Co.**, Boston.

Imperial Oil, Ltd.

Project: 37 miles of 12-in. from Waterdown to North Toronto, Ont.

Status: Under way.

Contractor: **Majestic Contractors, Ltd.** Otis Hare, spread superintendent, office at Cooksville, Ont.

Canadian Gas Pipelines

• **Alberta Gas Trunk Line Co., Ltd.**

Project: 637 miles of 34 to 16-in. gathering lines in Alberta.

Contractor: **Dutton-Williams Brothers, Ltd.** has preliminary studies, design and management-engineering. **Universal Pipe Line, Ltd.**, subsidiary of Mannix, Ltd., jointly with **Marine Pipeline & Dredging Co.**, has crossing of Red Deer River near Cavendish, Alta., J. Hysuick, spread superintendent, office at Empress. **Fulton Banister, Ltd.**, has part.

Status: River crossing completed. Total project to be completed in 1960.

Project: 17 miles of 34-in. west from Trans-Canada pipeline origin near Burstall, Sask., to near Cavendish, Alta.; 100 miles of 18-in. north to Bindloss and Provost fields.

Status: To start May 1957.

Completion: Sumer 1957.

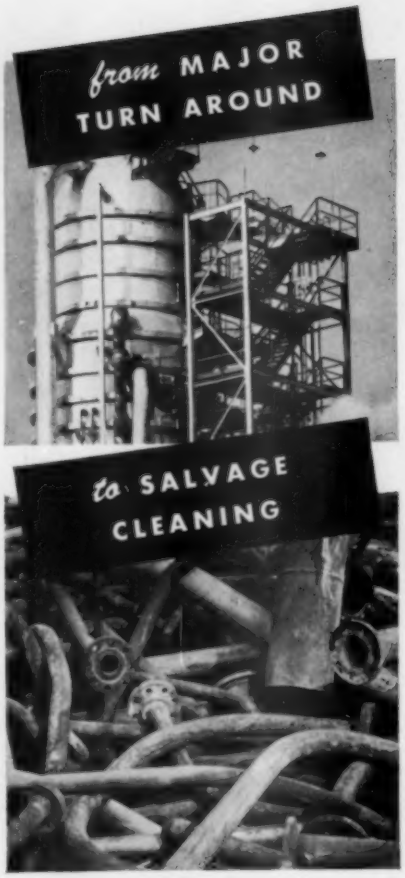
Inland Natural Gas Co., Ltd.

Project: 304 miles of mainline and 25 miles of laterals from Savona to Nelson, B. C.: 150 miles of 12-in.; 112 miles of 10-in.; 67 miles of 6-in. Also will build 400 miles of distribution piping in 31 towns.

Status: Under way.

Contractor: **Dutton-Williams Brothers, Ltd.** Pat Campbell, project manager, office at Penticton.

Completion: October 1, 1957.



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In a refinery at turn-around time, the Oakite man recommended in-place cleaning procedures and materials that gave virtually 95% perfect results—cut costly tower down-time 25%.

With Oakite materials removing rust, soil and paint from salvageable pipe, fittings, valves and other parts, one refinery estimates savings in excess of $50,000 a year.

Just two jobs of the *many* where Oakite can help. Bulletin F-7629 tells more. Write Oakite Products, Inc., 39 Rector Street, New York 6, N. Y.

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Export Division Cable Address: Oakite

Technical Service Representatives in Principal Cities of U. S. and Canada

Pipeline Patrol

Plains-Western Gas & Electric
Project: 16 miles of 10-in. from the Trans-Canada Pipe Line to Brandon, Manitoba.
Contractor: **Banister Construction, Ltd.** George Caron, superintendent.
Completion: 1957.

Saskatchewan Power Corp.
Project: 13 miles of 4-in. lateral to town of Kerrobert, and 10 miles of 6-in. lateral to Kindersley Power Plant, Sask.
Status: Planned.
Contractor: **Banister Construction, Ltd.**
Completion: July 15, 1957.
Project: 300 miles of 1 to 20-in. distribution lines at Regina, Sask.
Status: Planned.
Contractor: **S. E. Construction (Alberta) Ltd.,** and **Pacific Pipeline Construction Alberta), Ltd.,** jointly.

• **Trans-Canada Pipe Lines, Ltd.**
Project: 574 miles of 34-in. from the Alberta-Saskatchewan border to Winnipeg. (First part of 2,250-mile line from Alberta to Toronto and Montreal.)
Status: Under way.
Contractors: **Majestic Contractors, Ltd.** (104 miles from Burstall to Stewart Valley, Sask., R. L. Leonard, spread supt., office at Cabri. **Canadian Bechtel, Ltd.** (110 miles from Swift Current to Moose Jaw, Sask., J. L. Work general supt., office at Moose Jaw, and 54 miles from Portage la Prairie to Winnipeg); **Universal Pipe Line, Ltd.,** subsidiary of **Mannix, Ltd.,** (90 miles from Moose Jaw to Welseley, spread superintendent, Otis Hare, office at Regina, Saskatchewan); **Dutton-Williams Brothers, Ltd.** (97 miles from Devereen to Moosomin, under way, to complete August 1957). **Price-Pools of Canada, Ltd.,** has 100 miles from Miniota to near McGregor to start in 1957. **Marine Pipeline & Dredging, Ltd.** has 30-in. Red River and Assiniboine crossing in Manitoba.
Completion: Red River crossing to be completed May 31. Assiniboine River crossing completed.

• **Union Gas Co. of Canada, Ltd.**
Project: 142 miles of 26-in. from Dawn Township to Hamilton, Ontario, plus 55 miles of 6 to 20-in. laterals, and 317 miles of 2 to 12-in. distribution lines.
Status: Planned.
Completion: November 30, 1957.
Project: 17 miles of 8 to 20-in. storage lines in Dawn Township, Ontario.
Status: Planned.
Completion: August 1957.

• **Westcoast Transmission Co., Ltd.**
Project: 650 miles of 30-in. from Peace River area, Canada, to Sumas, Wash.
Status: Under way. About two-thirds completed.
Contractors: **Dutton - Williams Brothers Ltd.,** has 120 miles from Taylor, B. C., to Azouzetta Lake, completed; **Universal Pipe Lines, Ltd.,** subsidiary of **Mannix, Ltd.,** has 110 miles between Huntingdon and Kingsvalle, B. C., F. L. Byers, spread superintendent, office at Hops, B. C.; **Canadian Bechtel, Ltd.,** has 210 miles from Alexandria to Pine Pass, B. C., H. F. (Hank) Mogg, spread man, office at Quesnel, B. C.; **R. A. Conyes Construction Co.,** has 210 miles; **River Construction Corp., Ltd.,** has under way 150 miles of gathering lines in northern Alberta and British Columbia; **Marine Pipeline & Dredging, Ltd.,** has Fraser and Peace River crossings, Waldo Trim, spread superintendent, offices at Fort Saint John and Hope, B. C.
Completion: Dutton-Williams section completed. R. A. Conyes section and Canadian Bechtel section to be completed September 1957. Marine Pipeline work to be completed June 30, 1957. Universal Pipe Lines, Ltd. will complete work September 1, 1957.
Project: 174 miles of 30-in. from Savanna Creek area to the Canadian-Idaho border.
Status: Proposed.

Foreign Crude-Oil Pipelines

Bolivian Gulf Oil Corp.
Project: 160 miles of 10-in. and 43 miles of 8-in. from Sicascia to Arica on the Chilean coast.
Status: Awaiting pipe.
Contractor: **Williams Brothers Co.**
Completion: December 1957.

• **Caltex**
Project: 30 miles of 30-in. from Duri field in Sumatra to Dumai where a deepwater terminal will be built. Line will be extended 35 miles of Minas field later.
Status: Planned.
Completion: Duri-Dumai line to be finished in 1959; extension to Minas later.

• **Colombian Petroleum Co.**
Project: 42 miles of 6-in. from Tibu field to Rio de Oro in Colombia.
Status: Planned.

• **C.R.E.P.S., Societe Nationale de Recherche et d'Exploitation des Petroles en Algerie (SN Repal), and Cie. Francaise des Petroles Algerie**
Project: Two 10-in. lines from Hassi Messaoud and Edjele, Algeria to the railhead at Touggourt.
Status: Planned.
Completion: 1958.

• **Creole Petroleum Corp.**
Project: 87 miles of 30-in. from Temblador field to Caripito in Venezuela.
Status: Planned.
Completion: 1959.
Project: 9 miles of 26-in. from Ule to La

PERRAULT PNEUMATIC INSIDE LINE-UP CLAMP

The first line-up clamp to align pipe center-on-center so that any inconsistencies in diameter are distributed all around, eliminating the time and damage of hammering. The air-operated studs bring pipe to a perfect circle, mating it perfectly, holding it rock-steady edge-to-edge, ready for a good stringer bead. It's easy to position, fast and easy to use. Available for pipe from 20" thru 36" on a rental basis. For the complete, wonderful details, write or phone . . .

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STRENGTH — Hubs and cover sleeves for sizes 1¼ A through 7A are machined from tough steel forgings. Hubs are keyed to the shafts. The two one-piece cover sleeves function as a single, rigid unit serving as a floating connecting link between the hubs. High strength of forgings makes possible a very compact coupling with low rotating inertia.

RELIABILITY — There are no flexible parts to bend or break and the coupling is dust, moisture, and oil tight. Patented Walflex seal is positioned where centrifugal force is least. Clearance between teeth in hubs and sleeve is engineered so that an oil wedge always separates them, taking the wear.

SERVICE — Plenty of rough bore couplings, already assembled—on the shelf for *immediate* delivery. Finish bored standard couplings shipped to meet customers' schedules. We are geared up to give you realistic delivery on *any* type of couplings.

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JOHN **WALDRON** CORP.

NEW BRUNSWICK, NEW JERSEY

Representatives In Principal Cities

Pipeline Patrol

Salina in Venezuela.
Status: Planned.
Completion: Late 1957.

• **Mene Grande Oil Co.**
Project: 59 miles of 30-in. from fields in Eastern Venezuela to Puerto La Cruz.
Status: To start in 1957.
Completion: First quarter 1958.

• **North-West Oil Pipelines Co.** (newly formed by six West German refiners, headed by affiliates of Standard Oil Co. (N.J.), and British Petroleum Co., Ltd.)
Project: 210-mile line from the refining centers in the industrial Ruhr area of West Germany to Wilhelmshaven.
Status: Planned.
Completion: 1959.

• **Royal Dutch-Shell**
Project: 700-mile line across Europe from the Mediterranean to the North Sea, running through Eastern France, Luxembourg, West Germany, and Netherlands, and Belgium. Main trunk to be 30-in.
Status: Company is considering project together with several other companies.

Sinclair Oil Corp. and Socony Mobil Oil Co.
Project: 211 miles of 20-in. from the Silvestre field in Barinas, Venezuela, to Puerto Cabello on Caribbean Sea.
Status: Under way.
Contractor: **Williams Brothers Sudamericano, Ltd.**
Completion: July 1957

• **Ste. Nationale de Recherche et d'Exploitation des Petroles en Algerie**
Project: Line in Sahara Desert area to move oil from Hassi Massaoud field. Two routes possible: 200 miles from the field northwest to Laghouat; 260 miles from the field to the north and slightly east to Biskra.
Status: Under study.

Yacimientos Petroliferos Fiscales (Argentina)
Project: 932 miles of 12-in. from Campo Duran to San Lorenzo.
Status: Under way.
Contractor: **TECHINT** (Compania Tecnica Internacional), Buenos Aires, has 90 miles.
Project: 497 miles from Mendoza to Buenos Aires.
Status: Proposed.

Foreign Products Pipelines

Israeli Government
Project: A 6-in. line from the Haifa refinery to Tel Aviv.
Completion: Late 1957.

National Iranian Oil Co.
Project: 573 miles of 10-in. from Ahwaz to Teheran, Iran.
Contractor: **Enterpose of Paris,** has northern 236 miles. Southern section completed.

• **North Atlantic Treaty Organization (NATO)**
Project: 2,000 miles of lines to airfields in parts of Europe.
Status: Under way.
Contractors: **Associated Pipeline Contractors, Inc.,** has 450 miles from Iskenderun, Turkey, to Batman. **TECHINT** (Compagnia Tecnica Internazionale), Milano, Italy, has 205 miles of 4-in. from Bandirma to Eskisehir, Turkey, and 250 miles of 8-in. from Antalya to Eskisehir. Bids were taken in January 1956 on 300 miles of 12-in. between Marseille and Langres, France. Taking bids on 275 miles in northwestern France: 54 miles of 2-in. from Langres to Mirecourt, 63 miles of 2-in. from Mirecourt to Phalsbourg, 47 miles of 8-in. from Mirecourt to Metz, 30 miles of 8-in. from Phalsbourg to Deux Ponts, 35 miles of 8-in. from Phalsbourg to Strasbourg.

United States Defense Department

(Continued on page 285)

When it comes to oil field metering... there's nothing better than

ROLOCHECK

equipment

ROLOCHECK Meters measure oil by alternately filling with and discharging exactly calibrated volumes of oil. Each cycle is counted on a new, rugged counter. ROLOCHECK Meters are designed for oil field use; **proven** in oil field service... no gadgets, no unnecessarily complicated controls to fail in unattended operations.

ROLOCHECK METERS. For use with existing separators or treaters. Available in various capacities and working pressures. Write for Bulletin 56R.

Features of ROLOCHECK Meters:

(1) **Extreme accuracy.** Upper and lower liquid levels are controlled in reduced-diameter necks.

(2) **No slippage.** The new Rolo Neutral-Position 3-Way Valve is of a special design which eliminates the possibility of both inlet and outlet ports being open at once when the valve is switching ports. **Oil cannot bypass the meter.**

(3) **Minimum maintenance.** Only internals are a float and a float guide rod. Valve has sturdy rubber-to-metal inner valves. Sand and other sediments are no problem.

Also:

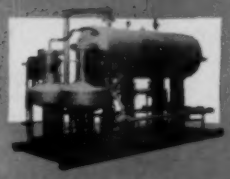
No minimum rate; will not pass free gas; new-design, rugged, foolproof counter. Equally efficient on oil or water measurement.

There's a ROLOCHECK Meter, in one of the forms shown on this page, for every application. Send in the coupon for complete information.

ROLOCHECK TWO-PHASE METERING SEPARATORS. Combine the ROLOCHECK Meter with an efficient separator, all in one vessel. Economical, space-saving. Write for Bulletin 56MS.

ROLOCHECK THREE-PHASE METERING SEPARATORS. Combine two ROLOCHECK Meters (one for oil and emulsion, one for free water) and a separator-free water knockout... all in one vessel. Write for Bulletin 56MS.

ROLO WELLCHECKERS. Completely piped separators with ROLOCHECK Meters and gas measurement facilities. Automatic free water knockouts, with ROLOCHECK Water Meters, optional. Available on skids or trailers. Write for Catalog 56W.



ROLO AUTOMATIC SAMPLER. The perfect sampling accessory to any ROLOCHECK Meter. For production containing free water, the addition of the Rolo Intermitter to the Rolo Sampler assures maximum sampling accuracy on even the highest water cuts. Write for Catalog 56W.

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Bulletin 56R ☐ Bulletin 56MS ☐ Catalog 56W ☐

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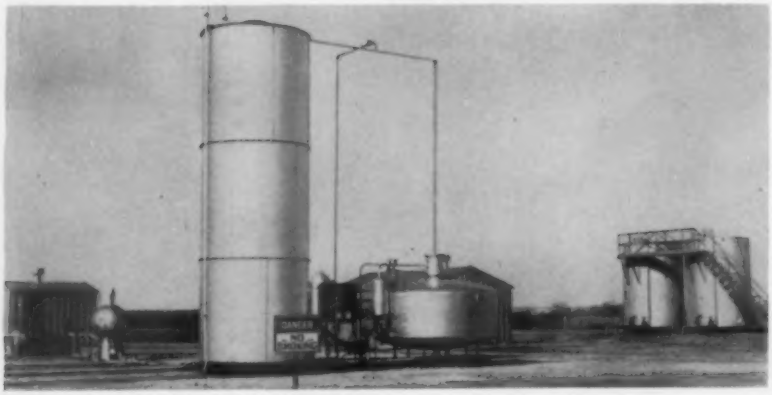
SHOWCASE...

NEW EQUIPMENT



B. S. & B. Introduces Phanto-Matic Packaged Lease-Automation System

Full lease automation from the wellhead to the pipeline can be achieved with this new B.S.&B. Phanto-Matic packaged lease-automation system, according to company officials.

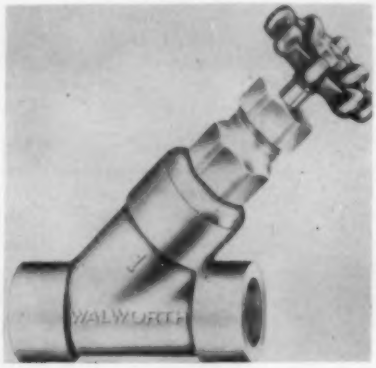
The system includes: (1) fully automatic wellhead shut-in control, (2) well-test control, (3) well-flow control, (4) tank switching, (5) custody transfer, (6) fluid metering, and (7) lease safety controls.

The packaged automation program, according to the company, offers producers greater accuracy, elimination of routine manual procedure on the lease sites, greater efficiency in all phases of lease operation, and substantial savings on operating expenses.

The lease automation component systems fall generaliy into two primary classifications — Phanto - Pumper systems and Phanto-Gager systems.

The Phanto-Pumper systems provide: (1) automatic wellhead controls which program production, (2) automatic well-testing equipment which automatically switches individual wells from production to testing and back to production and records test data, and (3) tank-battery control equipment which automatically fills all tanks to capacity in a preset sequence and automatically bypasses tanks already full or being run to the pipeline.

The Phanto - Gager systems (shown here) offer: (1) automatic measurement and recording of temperature-compensated oil volumen in barrels, (2) automatic measurement of quality and contaminant, and (3) automatic running of crude from lease into the connecting pipeline in accordance with predetermined schedules, on an unattended basis. **Write or call: Black, Sivalls & Bryson, Inc., 7500 East Twelfth Street, Kansas City 26, Mo., for details on Phanto-Matic lease systems.**



All-Plastic Valve Gives Full Flow Passage

A full-flow passage is a feature of this new all-plastic Y-globe valve. Made of rigid polyvinyl chloride the valve provides tight shutoff and flow control of alkalis, acids, inorganic salt solutions, and other corrosive fluids used in the oil, gas, and petrochemical industries.

Nontoxic and noncorroding, the valve assures fluid purity, the maker states. A special bonnet and gland-nut design provides a leakproof unit. Because of its sturdy construction, the valve will operate successfully at pressures up to 150 psi. at 75° F.

Send this **Showcase Coupon**

to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

.....

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Described in OIL AND GAS JOURNAL - Issue of **April 29, 1957**

NAME.....TITLE.....

COMPANY.....

ADDRESS.....

CITY.....STATE.....

DATE.....

New Equipment

Each part is resistant to outside corrosion from plant fumes, drippings, and other atmospheric hazards. A tapered back seat on the stem permits repacking under pressure. The same design also reduces pressure on the stem packing when the valve is opened completely. The valve will be available with threaded and solvent-weld socket type of ends. Present available size is 1 in. Sizes from ½ through 2 in. will be available soon. **Write or call: Walworth Co., 60 East Forty-second Street, New York, N. Y., for details on all-plastic Y-globe valve.**

●

Forged-Steel Needle Valve Has Safety Bonnet

This forged-steel needle valve featuring a safety bonnet is specifically designed for high-pressure chemical and petroleum service.

Suited for high-pressure throttling, gaging, or sampling services, it's available from stock in ¼, ⅜, ½, and ¾-in. sizes. Type 416 stainless steel and other alloys can be obtained on special order. **Write or call: August Spindler & Sons, Inc., 244 Mercer Street, Jersey City 2, N. J., for details on needle valve with safety bonnet.**

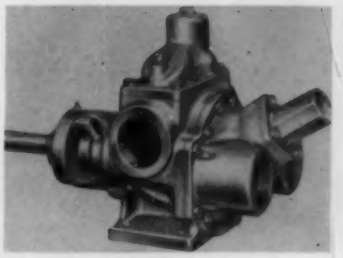
●

Controller Sounds Alarm If Trouble Occurs

When installed on demineralizing equipment, this new Robotel signalling system provides both an alarm and a record of improper functioning of any component in the demineralizing equipment which is intended to operate in accordance with a predetermined program. The controller also provides for automatic shutdown of the programed operation, if desired.

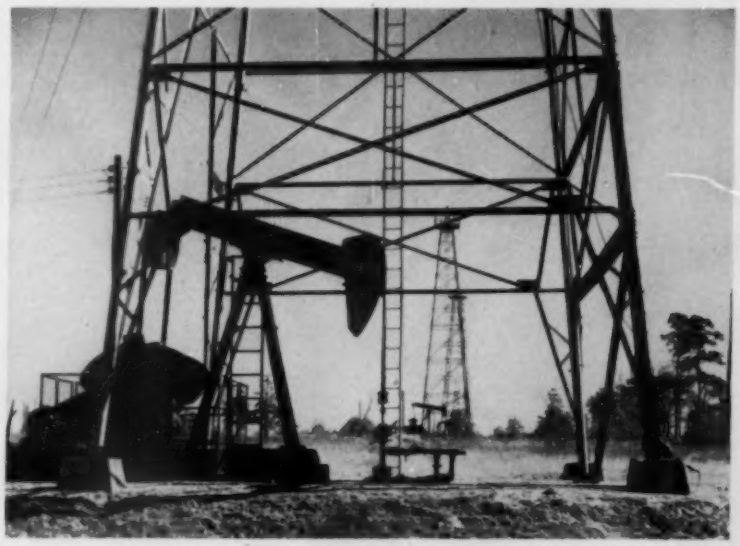
The controller assumes that sooner or later a failure of a component will occur in any automatic control system. Depending upon the nature and complexity of the system, such failure may be difficult to locate and correct promptly.

By means of the controller, the location of the function failure is indicated, alarmed, and recorded, thus locating the failure immediately and making possible its speedy correction. **Write or call: Infilco, Inc., P. O. Box 5033, Tucson, Ariz., for Reprint 66 on Robotel.**



Rotary P-D Pump Handles Dry Aromatic Liquids

This new pump offers excellent service characteristics for pumping dry



IS CASING CORROSION A PROBLEM IN YOUR WELLS?

This case history tells how three companies stopped external casing corrosion on 70 of their oil and gas wells in Western Kansas. It was thought that Dakota water was the cause of most of the corrosion.

The companies called on CSI to survey the wells and determine the current requirements for cathodic protection. These ranged from 0.8 to 3.10 amperes. Then CSI was engaged to complete the job.

Galvomags, Dow's high-potential magnesium anodes, were installed to protect the casing. CSI furnished all engineering, labor, materials and installation equipment, including power augers and ditchers.

The cost averaged $350 per well—for installations designed to give 10 years of protection. The work took 30 days.

Call or write today for engineering or installation help with your corrosion problems—well casing, pipe line, etc. CSI also offers a complete line of quality cathodic protection materials at competitive prices. Estimates or quotations without obligation.

CSI

CORROSION SERVICES INCORPORATED

Tulsa, Oklahoma

P. O. Box 7343, Dept. J-7 **Telephone: Circle 5-1351**

New Equipment

aromatic liquids or other petroleum products, the maker states. The Type A pump is designed with self-lubricating bearings so no lubricants will contaminate the liquids.

The hardened and ground-steel shaft bearings and steel-sleeved stub-shaft bearings are manufactured to provide long maintenance-free service. Radial-thrust ball bearings and outboard-thrust collars protect the pump against power-takeoff thrust and preloads. Mechanical seals prevent leaking stuffing boxes.

The Granco pump is available in capacities from 25 to 300 g.p.m. It's suited for pumping all aromatic liquids, such as benzene derivatives, ketones, and other types of extremely dry solvents. **Write or call: Granberg Corp., 1308 Sixty-Seventh Street, Oakland 8, Calif., for details on Type A pump.**

●

Tone-Squelch System Aids Two-Way Radio Use

Here's a new tone-squelch system designed to relieve two-way radio users in the petroleum industry of the necessity of listening to transmissions of other operators sharing the same channel.

The new product, called Channel Guard, combines the advantages of both tone squelch and conventional noise squelch. Providing one-way or two-way protection against unwanted calls, noise, and disruptive interference, it enables two or more users in the same geographical area to share a channel without having to listen to messages other than their own.

The system superimposes a continuous tone on normal squelch to assure a high degree of privacy in communications.

One of the features included in the system is automatic monitoring before transmission. This permits the operator to determine whether anyone is using the channel the instant he picks up the microphone.

Because he is able to hear any transmission being made on his frequency, he knows immediately whether the channel is clear and is able to send a message without having the communication interrupted. **Write or call: General Electric Co., Communication Products Dept., Electronics Park, Syracuse, N. Y., for details on Channel Guard.**

●

Flanged Clamp Stops Leaks at Pipe Joints

Leaks at the joints of a water pipe can be quickly stopped with this new flanged clamp, according to the maker. It also strengthens joints where a leak has weakened and loosened them. The device clamps tightly on both the threaded pipe end and the fitting, reinforcing the joint.

An expanded end laps over the band of the fitting. Inside the clamp there is a cut-back to make room for a soft-U-shaped neoprene-rubber ring. This ring is squeezed into the threads at the source of the leak when the clamp

GET THE FACTS . .

MAXIM

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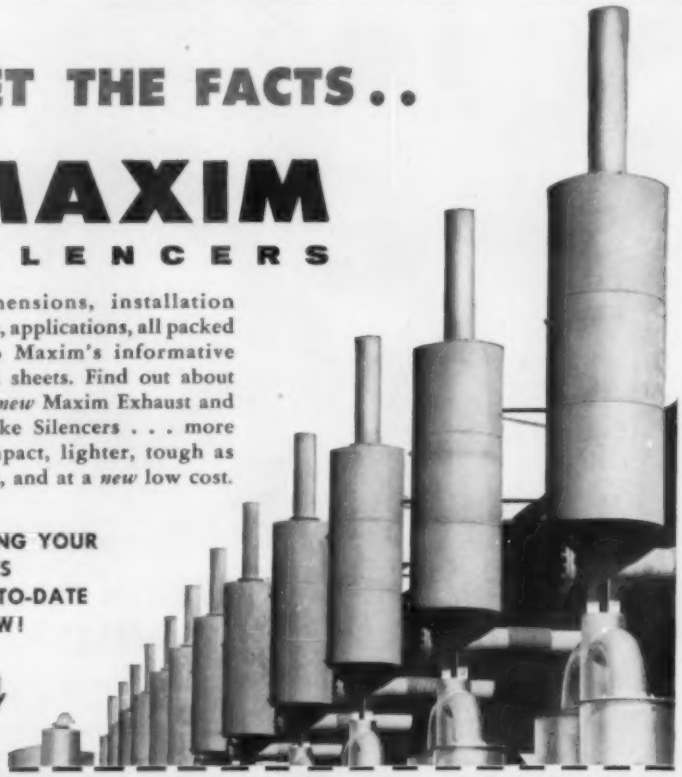
Dimensions, installation data, applications, all packed into Maxim's informative data sheets. Find out about the *new* Maxim Exhaust and Intake Silencers . . . more compact, lighter, tough as ever, and at a *new* low cost.

BRING YOUR FILES UP-TO-DATE NOW!



THE MAXIM SILENCER COMPANY

Subsidiary of Emhart Manufacturing Company

98 Homestead Ave., Hartford, Conn.

Gentlemen: Please send bulletins on silencers for: ☐ WASTE HEAT RECOVERY

☐ INTERNAL COMBUSTION AND STEAM ENGINE EXHAUST AND INTAKE ☐ AIR COMPRESSOR INTAKES AND DISCHARGES ☐ VACUUM PUMP DISCHARGES

☐ BLOWER INTAKES AND DISCHARGES ☐ STEAM, AIR OR GAS DISCHARGES ☐ JET AIRPLANE ENGINE EXHAUST AND INTAKE

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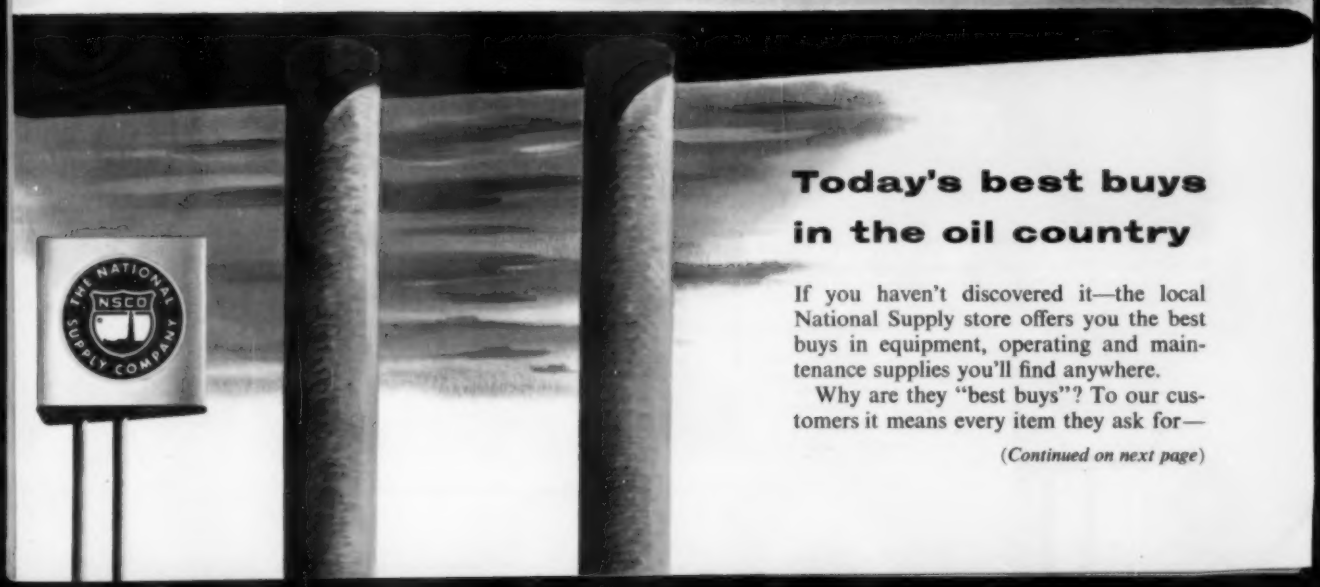


Today's best buys in the oil country

If you haven't discovered it—the local National Supply store offers you the best buys in equipment, operating and maintenance supplies you'll find anywhere.

Why are they "best buys"? To our customers it means every item they ask for—

(*Continued on next page*)

be it swages, fittings, pump parts, bearings, wire line—is of the best and highest quality obtainable.

And, because National store men make it their business to anticipate the needs of operators in their areas, stock items are available to fill those needs. If a special item, not normally stocked, is needed—it is ordered in the fastest way possible.

Tailoring equipment and supply inventory to your specific needs any day of the week is not an easy task. Hundreds of National field personnel and 128 stores work at the job around the clock. Moving your rig into a new territory? You'll find maintenance items quickly available at the nearest National Store. Thinking of a water-flood plant? Replacing pumpers? Need new wellhead assemblies? Equipment, supplies and operating information are as near as your local National store.

The best buy of all to many of our customers is the brand of service that comes with every purchase. Prompt handling, concern for performance and extraordinary assistance in emergencies is standard policy in National Supply store operations.

Add them all up—top quality products, in sizes and types that you specifically need, operating information, and extraordinary service. To most oilmen, this means "best buys." Why not visit your National Supply store soon and see for yourself?

Modern National Store interiors are designed to give you convenient "picture window" views of equipment, parts and accessories.

You can minimize the costly dangers of internal corrosion and paraffin accumulation by using Spang plastic coating—the only plastic coating in the industry applied at the mill. Order your next string of Spang Tubing plastic coated.

Rigid mill control standards insure SPANG® tubing quality

From the rolling of billets (see above) through each successive manufacturing step, Spang Tubing is completely quality-controlled by a series of accurate tests and inspections. The results are these outstanding features of two fine Spang Tubing products:

Spang Extreme Line Tubing

• Provides maximum running speed; fast joint make-up • Has 100% joint strength • Provides 100% resistance to leakage • Has 50% less connections • Provides positive shoulder contact engagement • Has a streamlined exterior • Is available in grades J-55, N-80 and P-105 to suit every well condition.

Spangseal Tubing

• Has 50% less connections • Provides 100% resistance to leakage • Provides more hole clearance • Eliminates "hanging-up" while running • Available in grades J-55, N-80, and P-105 for every well condition.

Gain the operating profit benefits of using tubing that will give you greatest performance. Order quality Spang Tubing from National Supply today.

SPANG-CHALFANT DIVISION

MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
DIVISION TUBULAR OFFICES: Denver, Colorado; Houston, Texas; Fort Worth, Texas; Los Angeles, California; New York, N.Y.; Toledo, Ohio; Tulsa, Oklahoma; Calgary, Alberta, Canada
NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

On the next page, another quality Spang product...

SPANG® CW

Steel Pipe... there's no extra cost for its special quality

Careful manufacturing control is the reason why Spang CW is your best buy for every type of piping installation.

Rigid tests and inspections during manufacturing and before shipping insure long service life of Spang CW Pipe. Every length is hydrostatically tested and inspected for thread quality and uniformity.

Such quality control features pay off wherever you use Spang CW Pipe—and, most important, you pay no more for this top-product assurance.

All sizes of Spang CW—plain end, or threaded and coupled—are readily available at your nearest National Store. Order now for your next job!

GATHERING LINE SERVICE is one of the many oil field applications for dependable Spang CW Pipe. In addition to gas, oil and water lines, you can use it for roof rails, step rails and other structural purposes.

SPANG-CHALFANT DIVISION

MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
DIVISION TUBULAR OFFICES: Denver, Colorado; Houston, Texas; Fort Worth, Texas; Los Angeles, California; New York, N.Y.; Toledo, Ohio; Tulsa, Oklahoma; Calgary, Alberta, Canada
NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

SHOWCASE . . .

New Equipment

is tightened into place with its four bolts.

Each half of the clamp has a long tongue on the inside. This tongue fits into a deep channel to make a compact pipe sleeve—even if the pipe is out of alignment.

The clamp is made of cast aluminum in five sizes from ¾ to 2 in. to fit standard malleable fittings, wrought and steel pipe, 85 per cent copper pipe, and screwed brass fittings. **Write or call: Burlis Products Co., 1619 Bergen Street, Brooklyn 13, N. Y., for details on flanged clamp for pipe joints.**

•

Optical Device Measures Displacement, Vibration

Both displacement and vibration can be measured with this new optical device called the Optron. It works on any material regardless of size, shape, or composition, according to the manufacturer. It may be used to measure amplitude, frequency, and waveform of vibration pickups, accelerometers, relay contacts, etc. No contact is made with the work.

A spot of light with an effective diameter of 0.0001 in. from a cathode-ray tube with a frequency response of 1 megacycle is projected by an optical system comprising a 100 X microscope onto the work. A multiplier photocell causes this spot to follow the motion.

Accuracies of measurement are in microinches. Full-scale range may be as high as 10 in. with different optical systems. **Write or call: Optron Corp., 3526 State Street, Santa Barbara, Calif., for details on Optron.**

Hollow-Stem Auger Permits Undisturbed Sampling

Undisturbed sampling can be done with this MDX 9026 hollow-stem auger, without withdrawing the auger from the drilled hole, according to the manufacturer. It's available in diameters from 7 to 10 in. o.d., 2¾ to 6 in. i.d., and in lengths from 2 to 10 ft. The auger acts as its own casing and has been effectively field tested to depths as great as 100 ft., the maker states.

A removable plug in the drill head on the auger prevents material from entering the auger core. When the desired depth has been reached, the plug is removed and the sampling tool lowered through the hollow auger to the strata to be tested. Wash or forced samples can be taken.

The hollow-stem auger may be used in any instance where casing or pipe is normally used, either to take disturbed or undisturbed samples or to add something to the ground. It also

STOP
SPRAY HEAD TROUBLES!
CONTROLLED SPRAY PATTERN WITH LOW PRESSURES!

Here is a spray head that operates efficiently on pressures under 5 pounds; is self cleaning and offers no resistance to the 1" water discharge. Result: Maximum cooling, minimum pumping costs, minimum clogging. Nylon rotor body, Graphite inserts, and Stainless Steel. Proved long life and low cost.

Write for Data.
N. C. STEARNS CO.,
Box 1234
Shreveport, Louisiana

"... does things others can't!"
STEARNS
GYROSPRAY®
For Cooling Towers and Spray Ponds

"According to Hoil"
H₂OIL GAS® GARD
FOR USE ON • PUMPING UNITS • TREATERS • DRILLING RIGS • COMPRESSORS • BUILDINGS

The H₂Oil Gas Gard is a safety device carefully designed and engineered to assure 100% protection against the numerous hazards involved where wet gas installations prevail. Its diversified applications make this unit a "MUST" where safety and economy are the prime objectives. Positive shut-off. 4" x 30" 125#—$54.50, F.O.B. Tulsa, Okla. Available in any size and pressure.

U. S. Pat. 2,710,666 Canadian Pat. 523,467

H₂OIL "GAGE IT"

• NO BATTERIES
• ACCURATE MEASUREMENT
• EASY TO READ
• SIMPLE TO OPERATE
• NOTHING TO WEAR OUT
• A NECESSITY FOR ALL PERSONS WHO MEASURE OIL
• ADAPTABLE TO ANY GAGE LINE

The H₂Oil "Gage-it" retails for $42.50. Approximate Packaged Weight Two Lbs. Standard Length Gage Tapes Available on Request.

The "Gage-it" is a device for determining the Water-Oil interface in a stock tank when attached to any standard type gauge line. It will also determine the Water-B.S. interface provided the B.S. carries enough water that a current may be established from the shell of the tank to the gauge plumb bob.

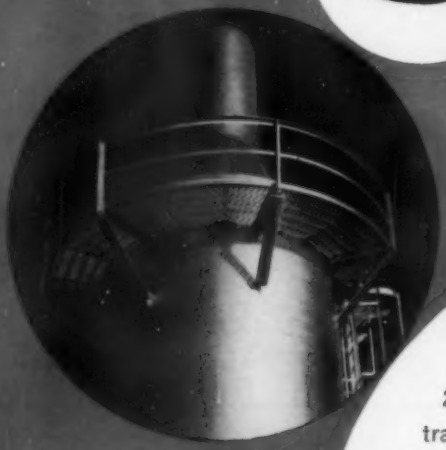
H₂OIL ENGINEERING CORP.
1601 South Yale TULSA 16, OKLA. P. O. Box 5094, Donaldson Station

you can judge

the comparative values of furnace design as applied to operating requirements.

It's quite simple

there are **9** basic factors which must be evaluated to obtain the full comparison of values



Whenever all these 9 specifications are applied to all the operating requirements, you can be sure PETROCHEM ISOFLOW FURNACES will be found most economically desirable.

No other furnace design can claim the recognition and acceptance achieved by PETROCHEM ISOFLOW FURNACES . . . starting with one installation in 1940, January '57 records more than 1650 ISOFLOW FURNACES in operation and under construction—a record that is incomparable just as all Petrochem Isoflow furnaces are more economically desirable by any comparison.

1—Average radiant transfer rate. **2**—Maximum deviation from average radiant transfer rate. **3**—Average and maximum transfer rate in convection section. **4**—Maximum tube wall temperature, radiant or convection. **5**—Maximum efficiency with specified excess air. **6**—Controlled thermal recirculation of flue gases to provide even heat distribution throughout full length of each tube and equalized heat distribution around each tube. **7**—Overload and corresponding transfer load. **8**—Design to provide: structural column supports · Ladders · Platforms · Tube Removal facilities, etc. **9**—Degree of assembly; of the furnace structure and of the heating surface.

PETROCHEM-ISOFLOW FURNACES

UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

PETRO-CHEM DEVELOPMENT CO., INC. • 122 EAST 42nd St., New York 17, N. Y.

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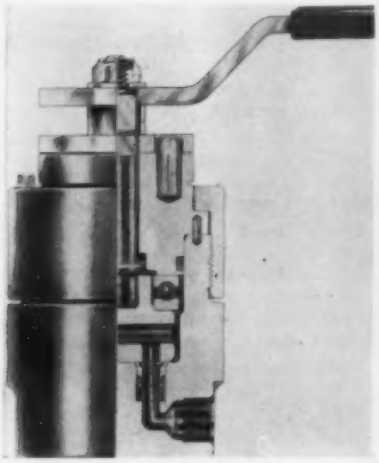
New Equipment

acts as a means of casing off an area to rock.

Coring may be continued through the hollow stem of the auger after rock has been reached. The center plug is removed and a diamond-bit core barrel placed into the auger and lowered to rock. Standard core-drilling procedure is then followed. **Write or call: Mobile Drilling, Inc., Dept. 18, 960 North Pennsylvania Street, Indianapolis, Ind., for details on MDX 9026 auger.**

•



Shut-Off Valve Carries 10,000 Psi. Rating

Though this new shear seal shutoff valve is rated for liquid or gases at 10,000 psi., it will withstand surges of up to 15,000 psi. without damage to the valve, the maker states. It is designed for a burst pressure of 40,000 psi.

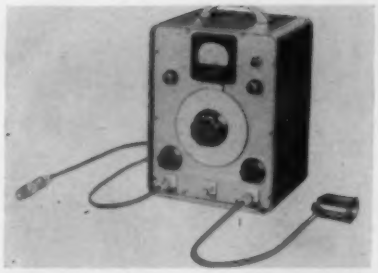
The valve can be obtained for pipe, tubes, or special high-pressure connections. **Write or call: Barksdale Valves, 5125 Alcoa Avenue, Los Angeles 58, Calif., for details on shutoff valve.**

•

Indicator Directly Measures Pressure-Change Rate

The rate of pressure change can be measured with this new SLM transducer system. Utilizing an electrostatic principle, the Model PI-114 instrument is rugged and reliable, the maker states.

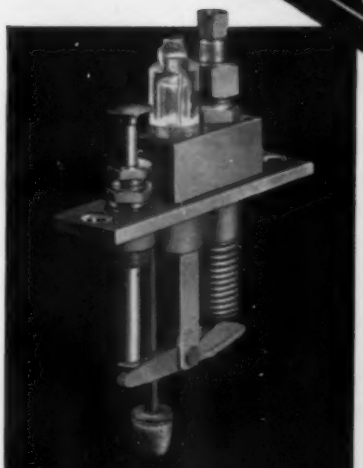
Through the use of an adaptor and resistor element, the electrical current (rate of change of charge) generated in the Swiss-made quartz-crystal transducer is measured by an electrostatic type of amplifier and displayed on a standard oscilloscope or recorder.



Featuring fast response (15-microsecond rise time) and high sensitivity, the instrument is described as being valuable for studying cylinder processes on engines and compressors, It is especially useful for indicating combustion and detonation phenomena in the evaluation of new engines and fuels. Other appplications include hydraulic and pneumatic systems.

According to the maker, the precision stainless-steel pickup (transducer) is rugged enough to withstand diesel combustion and other temperatures up to 600° F., without special air or water cooling. **Write or call: Kistler Instrument Corp., 15 Webster Street, North Tonawanda, N. Y., for Bulletin PI-114.**

FEATURES THAT MAKE McCORD *Model 55* The Outstanding Lubricator in the Oil Industry



McCORD Model 55 pumps are interchangeable with McCORD Type "SF"

MOST ACCURATE LUBRICATOR EVER DEVELOPED

1. DRY SIGHT FEED . . . No glycerine—No Maintenance.
2. CALIBRATED DROP . . . A McCord First—Makes the Model "55" the most accurate lubricator ever developed.
3. POSITIVE! . . . No possibility of undetected leakage.
4. UNIT CONSTRUCTION . . . Entire pump assembly accessible by removal of 2 capscrews.
5. HIGHEST PRESSURES . . . Easily handled with standard lubricator.
6. LONGER LIFE . . . Due to longer plunger and more sealing area.

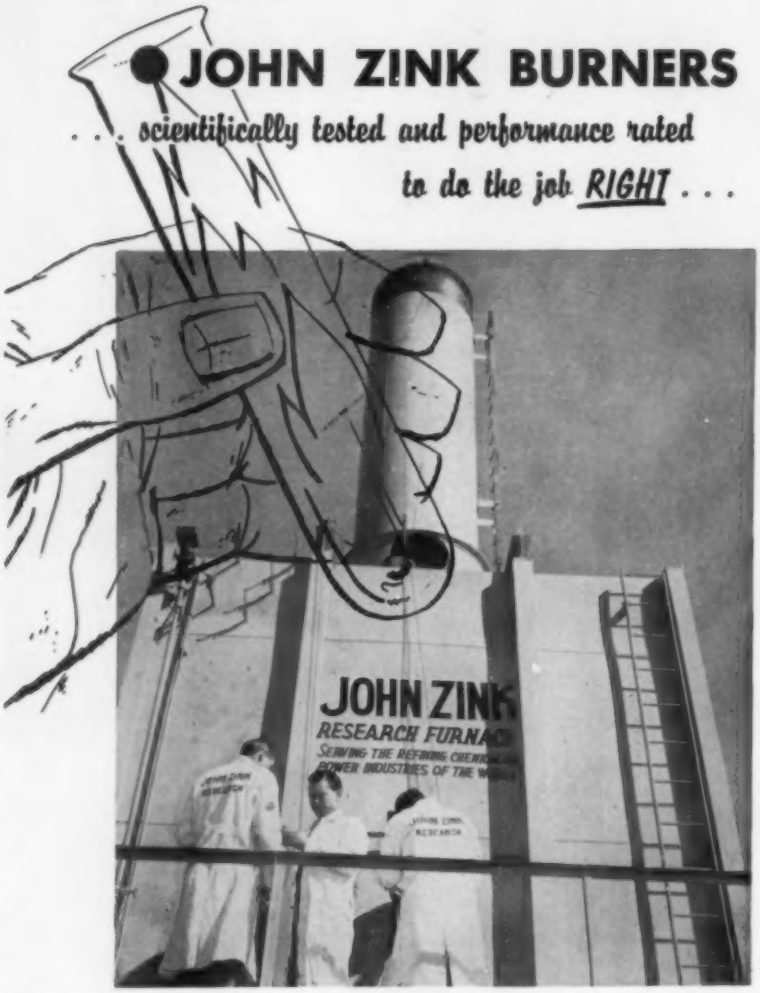
SPECIFY McCORD AND BE SURE

Send for your copy of the interesting bulletin on McCORD MODEL "55" LUBRICATOR.

LUBRICATOR DIVISION McCORD CORPORATION · Detroit 11, Mich.

JOHN ZINK BURNERS

. . . scientifically tested and performance rated to do the job RIGHT . . .



This research furnace affords an ideal proving ground for design changes in standard lines of burners, as well as enabling the John Zink Company to find *workable* solutions to new problems. In this way the John Zink Company can offer you special burners for your individual application . . . burners that have been *performance tested* before they reach your job site.

→ *The facilities of the John Zink research furnace are available to industry.*

WE MAKE HEAT . . . AROUND THE WORLD

If you have a specialized industrial burner problem . . . JOHN ZINK has the answer . . .

JOHN ZINK COMPANY

4401 SOUTH PEORIA TULSA 5, OKLAHOMA

SHOWCASE . . .

New Literature

Hose Clamps, Tools and Fittings. Twelve-page Form Catalog 3-OORG-56 discusses uses and applications of Punch-Lok standard type of hose clamps, grooved hose fittings, and special tools and replacement parts. It contains instructions and tables on how to order the clamps and fittings. Well illustrated, the catalog devotes separate sections to such subjects as the Punch-Lok method, its uses and applications, and how to apply the clamps. **Write or call: Punch-Lok Co., 321 North Justine Street, Chicago 7, Ill., for Form Catalog 3-OORG-56.**

●

How to Use Microballoon Spheres on tanks equipped with mixers is explained in new Technical Bulletin MB-110. The bulletin includes a table for an intermittent mixing cycle, where the mixer is operated during both the filling and emptying cycles. The bulletin explains that it is possible to keep b.s. & w. in suspension by continuous operation of the mixer during the filling cycle. If the microballoon blanket ruptures during filling, it will reform when it rises away from the turbulence. **Write or call: Colton Chemical Co., Div. of Air Reduction Co., Inc., 1747 Chester Avenue, Cleveland 14, Ohio, for Bulletin MB-110.**

●

Fuel Injection System. How many parts are in the Cummins pressure-time fuel system? Is the fuel metered in the pump or in each individual injector? Does the fuel system have to be timed to the engine? These questions as well as many others are answered in new 12-page Bulletin 950138. The booklet, printed in four colors, is well illustrated. Cutaway views of the four fuel-pump assemblies as well as the injector make it possible for the reader to understand the inner workings of this diesel fuel system. The bulletin also devotes a section to optional governor arrangements. **Write or call: Cummins Engine Co., Inc., Columbus, Ind., for Bulletin 950138.**

●

Small Vertical Pressure Filters. New Publication 6321 describes Cochrane standard Type C vertical pressure filters for clarifying water by removal of suspended matter, turbidity, dirt, rust, oil, and color commonly found in surface waters. The publication furnishes details of operation, available sizes, and filtering capacity. **Write or call: Cochrane Corp., Seventeenth Street below**

Allegheny Avenue, Philadelphia 32, Pa., for Publication 6321.

•

Filters for Water and Aqueous Liquids are the subject of new four-page Bulletin GEO-501. Fully illustrated, the booklet contains technical data on each model, including number of gallons filtered per minute, operating pressures, tube lengths, pipe sizes, inlet and outlet sizes, height, and weight. A chart indicates pressure drop in pounds per square inch across a new honeycomb filter tube at various flow rates up to 7 g.p.m. **Write or call: Commercial Filters Corp., 2 Main Street, Melrose 76, Mass., for Booklet GEO-501.**

•

Corrosion Keys for Aluminum is the title of this new six-page foldout for use as a guide in determining the corrosion resistance of aluminum. The brochure makes extensive use of graphs which tell the yearly corrosion rate of more than 100 chemicals and other corrosive materials on aluminum. **Write or call: Reynolds Metals Co., 2500 South Third Street, Louisville, Ky., for brochure, "Corrosion Keys for Aluminum."**

•

Meters, Valves, Regulators. New condensed 28-page Catalog C-5000, Rev. 8, contains specifications and cutaway diagrams of Rockwell meters, regulators, and valves. The catalog includes photo-illustrated descriptions of the recently introduced Rockwell telapilot —with power pilot loading by remote control—and the Hypregun, a light, compact, and efficient air-operating valve-lubricant gun. **Write or call: Meter and Valve Div., Rockwell Mfg. Co., 500 North Lexington Avenue, Pittsburgh 8, Pa., for Catalog C-5000, Rev. 8.**

•

Speed Reducers, both concentric and right angle types, for application up to 140 hp. (up to 72,000 lb.-in. output torque) are the subject of 24-page Bulletin 1105. It gives horsepower and torque ratings as well as dimensions, overhung load and thrust capacities, and application pictures. The horsepower-selection tables show at a glance: (1) the standard output speeds that may be obtained with commonly used input speeds, and (2) the full range of horsepower ratings available for each standard output speed. Offered in a wide range of ratios between 1.49 to 1 and 1,459 to 1, these reducers may be connected to the prime mover by means of coupling, belt, or chain. **Write or call: Falk Corp., Dept. 255, 3001 West**

W&T V-notch Chlorinator installed at Esso's Baton Rouge Refinery feeds chlorine at rates up to 500 lbs./24 hr. Units are available with chlorine capacities up to 2000 lbs./24 hr.

NEW W&T V-NOTCH CHLORINATORS,

used at Oil Refineries, are rugged, easy to operate and moderately priced.

Esso Standard Oil Co. has a W&T V-notch Chlorinator installed at their Baton Rouge, La., Refinery. The chlorinator, installed in a small shed open to the sun and weather, chlorinates cooling water for slime control.

This type of installation would be considered rugged service for other equipment but V-notch Chlorinators are designed for such use. They are made of materials that are completely resistant to corrosion as well as weather. They are simple to operate and to maintain. In addition, W&T V-notch Chlorinators are an attractive piece of equipment, colored green to fit into industrial color schemes.

For more information about W&T V-notch Chlorinators, send for bulletin CD-44.

WALLACE & TIERNAN INCORPORATED

25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

ABSOLUTE PRESSURE INDICATOR

For Precise Vacuum Work

Ranges: From 0—50 mm to 0—800 mm Hg. absolute in six ranges
Accuracy: 1/300 of full scale
Sensitivity: 1/500 in *all* ranges
Dial Size: 2¾" or 6" diameter

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25 MAIN STREET, BELLEVILLE 9, N.J.

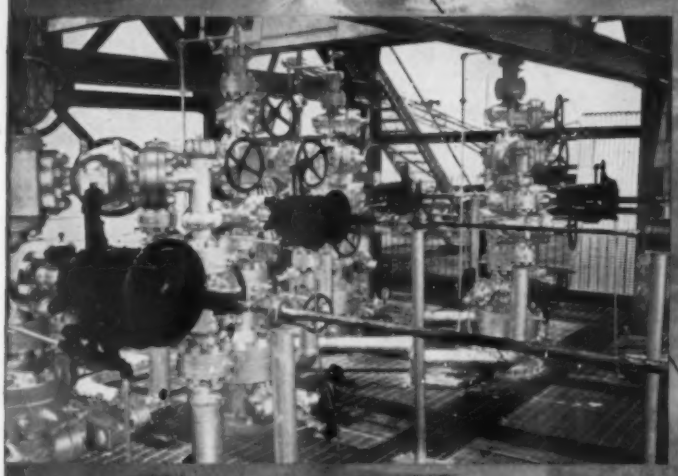
TYPE FA-160

Write for Publication No. TP-28-A

for that big one off shore

E-I-M

stands the Test...



It's just like fishing with a heavy test line when you install E-I-M Valve Controls. You can be sure that the well won't get away from you because E-I-M has a record of safety and dependability. Our engineers can solve your transmission problems with E-I-M Valve Controls for oil or gas lines off shore or across the continent.

The Pure Oil Company's platform in Rollover Field, 9 miles off the Louisiana coastline, has four producing wells, each using an E-I-M Valve Control for maximum safety to protect personnel and the platform.

E-I-M Company INCORPORATED

1340 OLD SPANISH TRAIL • HOUSTON 25, TEXAS • MOhawk 4-4587

valve controls • speed reducers • cooling tower drives • control valves

Canal Street, Milwaukee 1, Wis., for Bulletin 1105.

●

Liquid-Gas-Separation Equipment for volumes up to 7,000 s.c.f. per minute and pressures to 200 psig. are pictured and explained in new 10-page Bulletin S1052. A cutaway diagram shows the working principles of the Selas Liqui-Jector, a liquid-gas separation device for removal of entrained liquids and solids from air, gas, and steam systems. The bulletin gives specifications and contains tables furnishing operating and dimensional data on the separators. A foldout chart supplies data for selecting the proper standard equipment to meet particular processing needs. **Write or call: Selas Corp. of America, Dresher, Pa., for Bulletin S1052.**

●

Lightweight Concrete Mixer with a capacity of 3½ cu. ft. of mixed material, plus a 10 per cent overload, is illustrated and described in this four-page catalog. The mixer is powered by a 2.2-hp. air-cooled gasoline engine, or optional electric motor, with single V-belt power transmission. The all-welded steel drum is equipped with four mixing blades and a replaceable ring gear. The 18-in. drum opening and 40-in. charging height provides fast, easy loading. The catalog also describes plaster-mortar mixers and power wheelbarrows. **Write or call: Kwik-Mix Co., Port Washington, Wis., for Form KM 494.**

●

Gas Drilling Engine (four-cycle, six-cylinder) for handling many oil-field jobs is featured in new Bulletin 103. According to the bulletin, the engine's conservative horsepower rating assures adequate reserve power for extra-capacity loads, hoisting, and fast acceleration for easy pipe handling. The four-page colorful bulletin shows specifications, dimensions, and performance curves. And it diagrams the engine's optional power takeoff. **Write or call: White Diesel Engine Div., Springfield, Ohio, for Bulletin 103.**

●

Resurfacer for Concrete or Wood Floors, traffic aisles, ramps, platforms, driveways, stairways, and sidewalks is the subject of this new six-page folder. It explains how Stonhard resurfacer smooths out rutted and worn surfaces, making them slip-retardent, chipproof, tough, and resilient. The folder describes how the material insulates floors against cold. Photographs also show the applications of the material. **Write or call: Stonhard Co., Inc., 1306 Spring Garden Street, Philadelphia 23, Pa., for folder on Stonhard resurfacer.**

●

Nonelectronic Signal Generator System for measurement, indication, transmission, and control of a variety of process variables is set forth in new four-page Bulletin B257. The bulletin describes the new Norwood ElectroSyn system, said to be a unique method of obtaining reliable precision measurement of pressure, differential pressure, flow, liquid level, and temperature. Besides describing the system and its operation, the bulletin includes a diagram of possible system arrangements and explains optional components. **Write or call: Norwood Controls, Unit of Detroit Controls Corp., 934 Washington Street, Norwood, Mass., for Bulletin B257.**

●

Gripper-Sling Catalog. This new 18-page catalog illustrates and describes in detail a line of gripper slings. It gives typical applications and also contains complete price information. **Write or call: Cambridge Wire Cloth Co., 1515 Stonewood Road, Cambridge, Md., for gripper-sling catalog.**

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SERVICE
METER RUNS
MECO Standard Meter Runs conforming to A.G.A. specifications are made in our own fabricating shop of materials carried in stock. —Seamless steel pipe, Tube Turn welding fittings, Forged steel flanges, and Commercial Orifice fittings. Meter Runs are available bored and honed, coated bore for corrosive service, and to special designs.
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EQUIPMENT MEN . . . in the News

Dorr-Oliver to Build New World-Wide Headquarters

Dorr-Oliver, Inc. has recently broken ground for construction of a new $2½ million world-wide headquarters in Stamford, Conn. Located on an 18-acre tract, the new building will provide 120,000 sq. ft. of office space. Target date for occupancy is May 1958.

The new headquarters will house, in addition to executive and administrative staff, such departments as finance, sales, advertising, company relations, patent, and a major share of the company's technical divisions.

McCullough Appoints Ass't. Export Manager

GLEN HORRIE

The appointment of Glen Horrie as assistant export manager has been announced by I. J. McCullough, president of McCullough Tool Co.

Horrie joined McCullough Tool in 1949. After 3 years in the service and logging departments, he became a sales engineer at Bakersfield, Calif. Later he advanced to sales manager at Casper, Wyo., and just prior to his recent appointment, was San Joaquin district sales manager at Bakersfield. Horrie will make his headquarters at the Los Angeles general office.

Oilwell Appoints in Gulf Coast, Central Midwest

KING BOYD

The employment of King D. Boyd as area manager, drilling equipment sales, United States Steel Corp.'s Oil Well Supply Division, and naming of Von Douglas Yount as field representative at San Angelo, Tex., have been announced by William Miskimins, Central Midwest area manager of the division.

The appointment of James C. Hight and H. C. Streety as district representatives at New Orleans and Alice, Tex., has been announced by M. F. Jones, Gulf Coast area manager.

Boyd will be located at the Dallas office. Prior to his employment with Oilwell, he had 20 years sales-engineering experience with oil-field supply firms. Yount joined Oilwell in 1956 at San Angelo and prior to this had 6 years oil-field-supply experience. Hight was previously employed by Oilwell from 1947 to 1955 in various sales and managerial positions. Streety, who joined Oilwell in 1948, became field representative at Houston in 1949 and in 1951 was transferred to Victoria, Tex., as store manager. In 1954 he was appointed store manager at Alice, the position he held prior to his present appointment.

Cameron Transfers Lamberth and Shaheen

Scott M. Lamberth has been transferred from the sales and service office of Cameron Iron Works, Inc. at Lake Charles, La., to the firm's office in Farmington, N. M. A. G. (Alex) Shaheen has returned to the Houston valve sales force after representing the firm for the last 2 years in Venezuela.

Lamberth has been with Cameron since 1952. He will specialize in sales and service of high-pressure drilling controls, valves and christmas trees. Before going to Colombia, Shaheen worked as a roughneck and driller for various contractors, and in 1951, after 6 years in Colombia, he went to Kuwait, Persian Gulf, as a tool pusher.

Schlumberger Names Ass't. Area and District Managers

RALPH BURTON

Ralph Burton, formerly assistant manager of the North Louisiana area in Shreveport, has been transferred to Houston as assistant area manager of the Southwest area of Schlumberger Well Surveying Corp. The following have been named district managers: J. T. Douglas at Morgan City, La.; W. H. Player, Natchez, Miss.; P. H. Hines, Donaldsonville, La.; W. P. Baker, Evansville, Ind.; R. R. Shourd, Wichita Falls; and J. C. Givens, Big Lake, Tex.

Fuller Co. Formally Opens Compton, Calif., Plant

The new $1½ million Fuller Co. plant in Compton, Calif., was formally opened on April 9. Standing before the main entrance are: Henry Nelson, office manager; James Stellar, staff assistant; J. F. Smith, purchasing agent; Jack L. Verfurth, production manager; J. G. Wallace, sales manager, Kanigan division; John Colton, chief estimator; E. F. Bushman, sales representative, plastics division; and Harlan J. Thompson, general manager.

Weatherford Promotes Drury to Vice President

Fred Drury of Weatherford Oil Tool Co., Ltd., Edmonton, Alta., Canada, has been promoted from division manager to first vice president. After several years with Imperial Oil in Alberta, Drury joined Wotco, Ltd. in 1951.

Weatherford has been in Canada since 1948. Manufacturing operations were established in Edmonton in 1955.

Hatchitt, Berger Elected To Top Dresser A.G. Posts

HATCHITT

Following a 2-day annual international business conference held in Dallas, J. B. O'Connor, president of Dresser Industries, Inc. announced the election of Reece Hatchitt to the presidency of Dresser A.G., European affiliate of Dresser Industries, Inc.

Dresser's foreign business rose from $11,000,000 in 1950 to approximately $50,000,000 in 1956, and this segment of the firm's business now represents approximately 22 per cent of the firm's total annual sales of $230,000,000 as reported in the company's last annual report. The recent international business conference was called to review the company's overall foreign activities and to plan a future program to reach the $100,000,000 foreign business goal set by the meeting slogan "$99 million in '59."

The election of Dr. Hans Berger of Zurich, Switzerland, who has been president of Dresser A.G. since its formation in 1952, to chairman of the board of Dresser A.G. was also announced by O'Connor. Berger will remain with Dresser A.G. in an active executive position, working closely with Hatchitt in the firm's expanding overseas operations.

Hatchitt has been closely associated with Dresser's foreign affairs for several years, originally as a member of the corporation's legal staff and subsequently as director of foreign operations in which position he will continue to function in addition to his recent election. Prior to his affiliation with Dresser, Hatchitt resided in Chile and has worked in specialized foreign sales and other consulting assignments.

Central Division of Baker Oil Tools Holds Meeting

The Central division, Baker Oil Tools, Inc., recently held its annual sales meeting for district and branch managers at Corpus Christi, Tex. Attending the 2-day meeting were: (front row) W. G. Corgey, sales and service engineer, Corpus Christi; N. H. Lytton, district manager, Southwest Texas; D. C. Bianchi, division staff engineer; G. M. Anderson, division staff assistant; R. W. Henderson, vice president and assistant general manager; P. E. Hilton, manager, sales and service, Central division; C. C. Taylor, assistant manager, sales and service, Central division; G. A. Sullivant, district manager, Texas Gulf district; Marguerite Hunt, secretary, Corpus Christi.

Back row: R. W. Jones, branch manager, Freer; M. C. Muckleroy, branch manager, Corpus Christi; K. J. Evans, district staff engineer; W. F. Noxon, division sales engineer; D. A. Moody, branch manager, Victoria; W. M. Swafford, branch manager, McAllen; H. H. Fisher, division mechanical engineer; D. C. Lewis, branch manager, El Campo; P. A. Laake, branch manager, Luling; H. B. Edwards, branch manager, Falfurrias.

European Pipeline Men Visit M. J. Crose Plant

Two representatives from a large European pipeline construction company recently visited the Tulsa plant of M. J. Crose Manufacturing Co., Inc. Clare Miller, Crose vice president, discusses coating and wrapping with G. Chambrier, company spread man, and E. J. Perrussot, public relations man, both with the pipeline department of Societe Parisienne pour l'Industrie Electrique, Paris.

The Frenchmen have been in the United States several weeks attending the school of pipeline technology, an API-University of Texas sponsored center at Baytown, Tex. They visited the Crose plant to inspect the manufacture of machines used in their European and African pipeline construction projects.

Levingston Elects Executive Vice President

PENNINGTON

W. E. Pennington has been promoted to the post of executive vice president of Levingston Shipbuilding Co. of Orange, Tex., according to Ed T. Malloy, president. Pennington, with the company 22 years, started with the firm as a bookkeeper and has moved up through the posts of cost accountant, chief cost accountant, and production manager prior to assuming his former position of general manager in 1952.

Baroid Occupies New Office and Laboratory

Baroid Division, National Lead Co., is occupying a new building addition which subjoins the present general office building, Houston. This new construction provides Baroid with an additional 15,700 sq. ft. of office and lab-

oratory space. Six new laboratories are included and, with space being freed for four other labs in the present building, Baroid's laboratory space has been increased 43½ per cent.

Wilson Named Rector Sales Service Representative

James L. Wilson has been appointed sales service representative for Rector Well Equipment Co., Inc., it has been announced by J. L. Pinkard, sales manager.

In his new assignment, Wilson will cover the Texas Panhandle area, under the supervision of Bob Yanaway, and will make his headquarters in Pampa. Before joining the company he was with Shaffer Tool Works, where he was office manager.

S&R Tool Names Hartzog Mgr., Sales and Service

J. B. HARTZOG

James B. Hartzog has been appointed manager of sales and service for S & R Tool & Supply Co., Houston, it has been announced by George D. Conley, president. Hartzog, formerly with Ideco Division where he served for a number of years as manager of the specification and price department, later was appointed special assistant to the sales manager, and subsequently became manager of the full-view mast department.

J&L Supply Names Larsh, Webb, Berry to Sales Posts

John N. Larsh has been promoted from storeman to sales representative at Jones & Laughlin Supply Division's store at Midland, Tex. Robert C. Webb, salesman, has been transferred from Sherman, Tex., to Pampa, Tex. Roy E. Berry has been added to the firm's sales force as city sales representative at Amarillo, Tex. These appointments were recently announced by W. L. Wolfe, vice president-sales.

Larsh has served at the Midland store since he joined the firm in 1955. Webb, who joined the division in 1953, served as local store manager at Graham, Tex., until his promotion to salesman in the North Texas district.

The J&L sales office at Amarillo has recently been moved from the Amarillo Building to the Petroleum Building.

Layne & Bowler Celebrates Seventy-Fifth Anniversary

This year Layne & Bowler, Inc., celebrates its seventy-fifth anniversary. From its founding in the Dakota Territory in 1882 by Mahlon Layne, the firm offered an over-all service covering the entire ground-water-development job, from the initial survey for water to the finished well and the installed Layne pump. In 1901 the company expanded into Texas and was incorporated in 1907 with headquarters in Houston and branches through the South. In 1913 the main office and factory was moved to Memphis.

In 1927 M. E. Layne, the founder, died and Lloyd F. Layne was president until 1933. He was succeeded by J. G. Gordon, Jr., who retired in 1945. J. I. Seay served as president until 1957 when he became chairman of the board. W. H. Reeves is now president.

Inspecting these hand-made impellers are four long-time Layne & Bowler officials in the factory at Memphis, Tenn. They are: L. G. Ost, secretary-treasurer; A. O. Fabrin, vice president in charge of engineering; Frank T. Quinn, vice president in charge of manufacturing; and William H. Reeves, president.

Milwhite Names Four Vice Presidents, Division Mgr.

G. E. CONNER

George E. Conner has been promoted to the position of vice president in charge of sales, Sidney A. Adger to vice president in charge of public relations, and Richard F. Ladd to vice president and chief engineer of Milwhite Mud Sales Co. These appointments were announced by Henry David, president.

S. A. ADGER

R. F. LADD

The elevation of Edward R. Cadena to vice president in charge of Louisiana operations and Ralph Noble to Louisiana division manager was also announced by David. Cadena will continue to be located in Lafayette and Noble will be in Jennings.

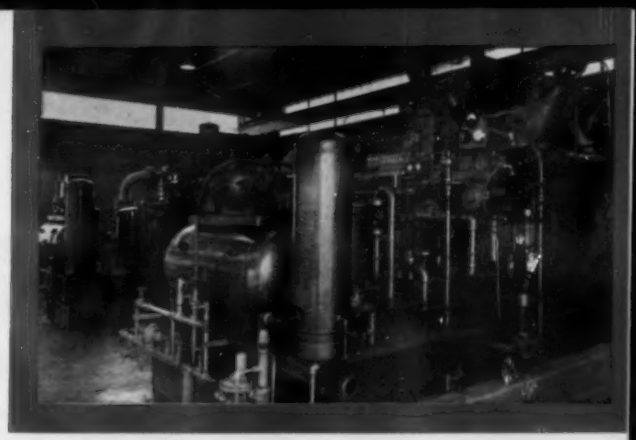
E. R. CADENA

RALPH NOBLE

Conner has been with Milwhite since 1954 and has served as sales manager during that period. Ladd has served in various capacities in West Texas and Houston since 1949. In his present post, he will be in charge of the field service phase of Milwhite's operations.

Lane-Wells Names Cruce as Division Sales Engineer

Jack Cruce has been appointed division sales engineer by Lane-Wells Co. He will be located in the firm's new Tulsa sales office in the Enterprise Building.

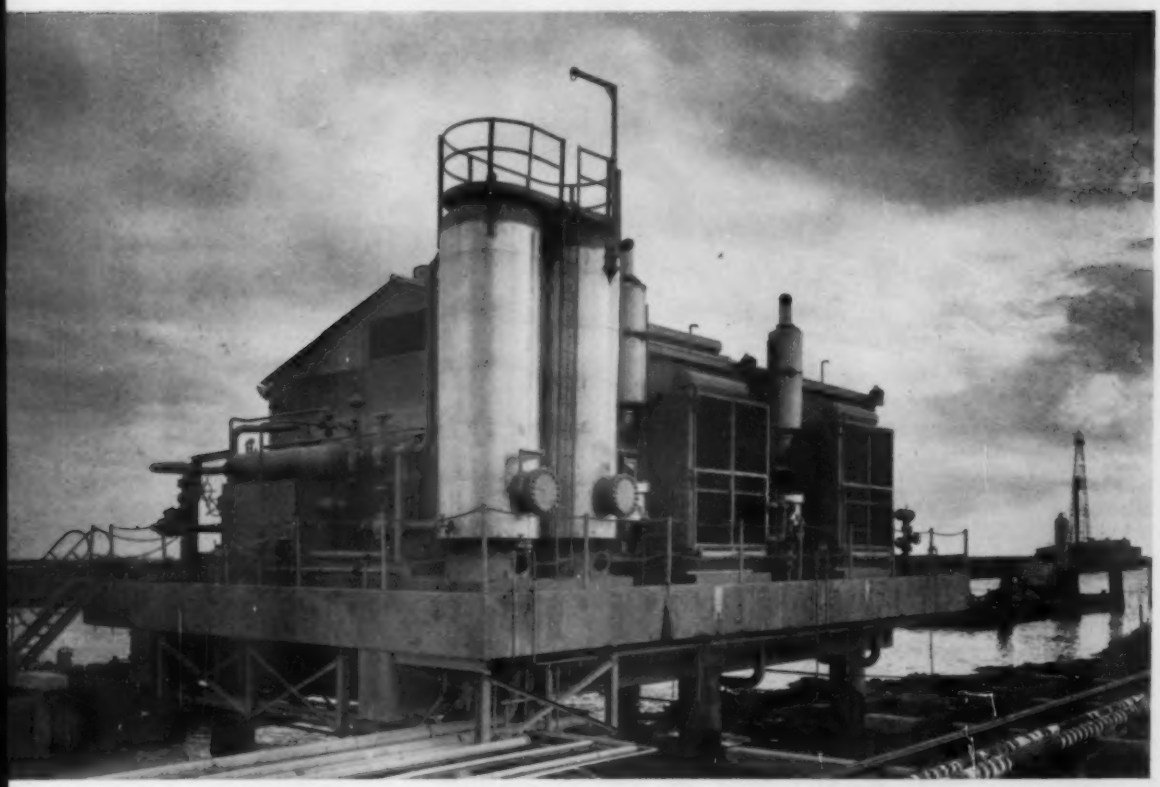


Southwest

PERFECT BALANCE FOR VIBRATION-FREE OPERATION

The perfect balance of these two Cooper-Bessemer GMXD-8 compressors and their packaged components allows them to compress 19 million cubic feet per day from 350 to 900 psi—vibration-free. Southwest Packaged Gas Compressors can be installed in any location to do any compressing job. They can be mounted on piling, pre-stressed concrete platforms, barges or wherever necessary for most economical installation and operation.

The unattended operation, possible with the automatic controls and safety devices on Southwest Packaged Compressor Plants, cuts operating costs per horsepower-hour to a fraction of the cost of a fully attended stationary installation. A Southwest engineer can show you actual comparative operating costs. Available in sizes from 265 h.p. to 660 h.p.



Shell Oil Company — South Pass, Louisiana

FOR GAS LIFT, GAS BOOSTER, PRESSURE MAINTENANCE AND SIMILAR PROJECTS.

SOUTHWEST INDUSTRIES, INC.

Post Office Box 7773, Houston 7, Texas

WIRE ROPE AT WORK

Northeast of Tioga, North Dakota, standing like a tall sentinel on the open prairie, this rig had drilled to 5300 ft when our photographer stopped by. It was at work on the Nelson Well No. 1, and the hole at that time was making good progress through crumbly shale and sand.

The neat, well-kept outfit is the property of Paul F. Rutledge Drilling Co., Santa Fe, N. M. For the rotary line, the owner consistently specifies 1⅛-in. Bethlehem Purple Strand, 6 x 21 Seale. The line shown here had 20,000 ton-miles to its credit, after approximately nine months on the rig. It was obviously "right" for the job it was doing; showed little evidence of wear, and looked fit for a long and useful life.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

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When Rockhounds Let Their Hair Down . . .

by Frank J. Gardner

IF you think **women** are talkers, just lend an ear. At the recent national convention of the American Association of Petroleum Geologists in St. Louis, this little scene took place. Tom, Dick, and Harry, three hardened convention-goers were relaxing in a corner at Kiel Auditorium. Their pithy comments may seem blunt, but much the same sentiment was sounded in more than one corner at that convention:

Dick: "Looks as if the program this time must have been taken over by the research labs. Man, I didn't understand one thing this morning; I'd better go back to school. It'd help a little if they'd have fewer papers with more time for delivery and for questions."

Tom: "Wel-l-l, there wasn't much to help you find oil, that's true, but it's good basic stuff for the youngsters, I guess. At least they can understand these new theories."

Harry: "And that's just it, Tom. The youngsters aren't here. All you see at these national meets are the old-timers, and all they come for is to see their old buddies. What's the matter with these oil companies, anyway? The young fellows are the ones who ought to be coming to these conventions . . . not the old ones!"

Tom: "Well, you know how it is. Rank and all that; at least that's the way it is in our company. And even rank doesn't always win. We had to draw lots to see which of the head men would come."

Dick: "Yep, I guess we'll always have rank to contend with; but any head man worth his salary should see the light and convince the top-level boys to send **more** men, not fewer men. This is where they meet their contemporaries, pick up new ideas, exchange theories, learn things."

Harry: "Well, maybe your company's different, but we brought a full team. We never miss it. Another company in our building sends a full team for the first two days, brings them home, and sends another full one for the last two days. Then when they get home, they write a report on what they think they learned."

Dick: "Seems to me the regional meets are taking the spotlight away from the national, anyway. Shorter travel, better papers . . . more oily, I mean. Why, that Salt Lake City meeting had more people than the national used to. And they're printing the papers in the May Bulletin of the A.A.P.G.—that's a new wrinkle. We used to have to wait as much as a year to see a meeting paper in print."

Tom: "Good old Salt Lake. I learned a lesson there. About one of the things we need, I mean."

Dick: "Here it comes, Harry. Tom's favorite theme, public relations."

Tom: "Well, if any group ever needed them, **we** do! Anyway, at this Salt Lake session, we met this guy from the local paper. Oil editor, he said, but he didn't know anything about oil. The Paradox play, it seems, was forcing the issue with him, and he had to learn about oil, period. 'I came down here,' he said, 'thinking that a geologist was some kind of a crackpot that went out every morning wearing two kinds of socks. But these fellows are young, alive, crewcut . . . and I'll bet every one of them has a degree of some kind.' Now if the public thinks of us as crackpots, I think we must do something about it."

Dick: "Yeah, about the only time a geologist breaks into newsprint is when he steals a map, or shoots his wife. Or else they have an earthquake, or somebody swipes a dinosaur egg."

Tom: "But we are making some progress. Had a big press conference here yesterday. Boy, the questions they asked that panel! Levorsen, Link, Hoover, Cram, Moody, Knebel . . . all the top rockhounds were there. Prize question from the press was 'Does the geologist get this money that the oil companies keep for a depletion allowance?' Man, we've got a long way to go, but if we have enough of these conferences, and break into the newspapers, favorably and often enough, maybe we can make the public rock-conscious. That'll help the industry, see?"

Harry: "Well, now, our Boy Scouts program has done a lot of good, too. And radio interviews like the one Gordon Atwater gave on offshore stuff at Chicago . . . they do the job. And in Denver and Tulsa, the geological societies are giving a night course for the science teachers in the local schools; they were swamped, boy, not only by the teachers, but by the general public that read about it. Everybody's interested in rocks."

Tom: "Lectures on the rocks, eh?"

Dick: "You suggesting something?"

Harry: "He did. He'll buy. Let's go."

GEOLOGIST MEETS THE PRESS . . . Gordon Atwater, consulting geologist (left), makes a tape recording for radio broadcast in Chicago. J. R. Watson (center) of station WMAQ, fires questions on offshore operations as Burton Thompson and Howard Hoelter, of the A.P.I.'s Oil Information Committee, look on.

British Columbia Brings In Second Oil Field, Promised a Third
Virginia Hills and Swan Hills — Most Important Wildcat News In Canada Since Red Earth
The Journal's Exploration Summary for March
Gas Discovery In Rocky Mountains
Quebec Lowlands Bags Large Gas Find
Rare Powder River Pennsylvanian Well Hits Oil
Madison Discovery Puts Heat On Sweetgrass Arch
Two New Paradox Fields, One Important Confirmation
Extensive Campaign Rolls On In Harper County
Deep Fillmore Field Extended East
Motley County Is Texas' Newest Producer
North Louisiana Hits Most Important Strike of Year
Bisti Region Returns To Wildcat Scene
Inshore-Offshore Drilling Hits All-Time High At Galveston
Riverside County Is California's Newest Producer
Deep Play Near Lovington Accelerated
Good Results In West Texas' Old Area Reexamination
BRITISH COLUMBIA
ONTARIO
QUEBEC
MONTANA
SOUTH DAKOTA
WISCONSIN
NEW YORK
MAINE
OHIO
WEST VA.
VIRGINIA
NORTH CAROLINA
SOUTH CAROLINA
UTAH
COLORADO
ARIZONA
TEXAS
LOUISIANA

New strikes at Virginia Hills and Swan Hills cause flurry as . . .

Wildcat Excitement Sweeps Across Alberta

by John C. McCaslin
District Editor

IMPORTANT discoveries in Montana, Wyoming, Utah, Cailifornia, New Mexico, Oklahoma, Texas, and Louisiana stepped aside for the most significant wildcat news in Canada since Red Earth Creek.

Major field unfolds . . . New wildcat excitement is sweeping across the central western plains of Alberta. The cause of this new exploratory flurry is the discovery of oil at Virginia Hills and Swan Hills, about 120 miles northwest of Edmonton.

Drilling plans now in the mill could outline a new oil-producing area of major importance. Home Oil Co. and associates started the play at 9-20 Virginia Hills in February. A drill-stem test in the Slave Point-Middle Devonian got 5,000 ft. of clean oil at 9,228-58 ft. and 2,400 ft. of gassy mud and oil emulsion, 50 per cent oil on another test at 9,259-85 ft.

Close on the heels of Virginia Hills came Swan Hills. Home et al 8-11 Swan Hills also is a Slave Point discovery, 25 miles northeast of Virginia Hills. The two discoveries are being labeled the most important wildcat events in Canada since Red Earth Creek. Here's why:

- They opened production in an entirely new horizon for western Canada, the Slave Point.
- Both are rank wildcats, 15 miles from any previous test on one side and 20 on the other.
- Virginia Hills and Swan Hills are further steps in a definite new trend in Canadian exploration into the vast, sparsely tested region of northwest and northern Alberta and Saskatchewan.

In the midst of industrywide attention, it is still too early, however, to

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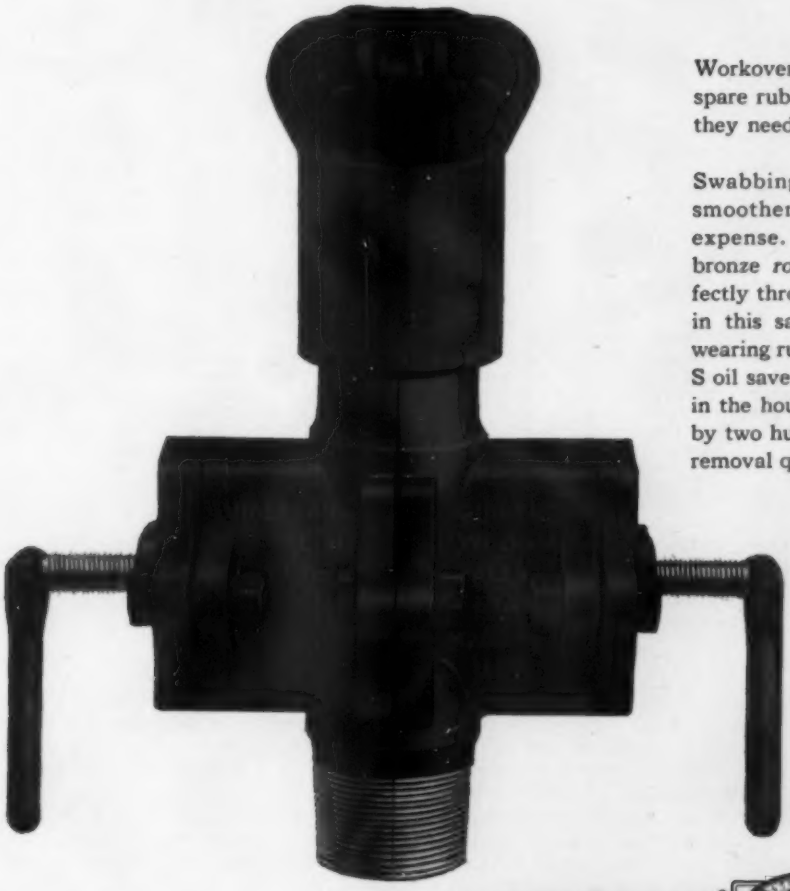
Type U Wire Line Oil Saver



Workover crews tell us they keep fewer spare rubbers on the rig for this saver — they need changing so seldom.

Swabbing operations go along a lot smoother with less trouble and less expense. Three durable special alloy bronze *rollers* center the wire line perfectly through the saver. And the rubbers in this saver are the same large, long-wearing rubbers used in Guiberson's Type S oil saver — they won't extrude or stick in the housing. Split-type housing, joined by two husky bolts, makes installation or removal quick and easy.

Use the Type U singly, or in tandem leaving off the roller cap on the lower saver. When you do need them, get Guiberson replacement rubbers packed two pair to a blue and yellow box.

Get the Best — Get Guiberson.

Available in 2" or 2½" EUE 8 round double pin sizes and 3" 8V line pipe or 3" EUE 8 round double pin sizes for ⅜"-⅜", ½"-⅝" or ¾"-1" wire line.

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Total March Completions, Exploration and Development

	Total completions							Total wildcat wells							Act.
	Total	Oil	Gas	Dry	Footage	Ser.	C.	Total	Oil	Gas	Dry	Footage	C.T.	D.D.	op.
Alabama	9	7	0	2	94,244	0	0	2	0	0	2	14,021	2	0	21
Arkansas	81	54	2	25	219,918	0	0	12	1	1	10	30,199	3	0	103
California	116	80	3	33	532,015	1	0	29	3	0	26	168,980	0	8	219
Colorado	52	8	2	42	268,993	0	0	37	2	0	35	192,070	0	0	109
Florida	1	0	0	1	4,755	0	0	1	0	0	1	4,755	0	0	1
Georgia	1	0	0	1	4,151	0	0	1	0	0	1	4,151	0	0	4
Illinois	139	42	4	93	322,668	0	0	36	0	1	35	82,408	35	4	426
Indiana	32	7	1	24	43,897	0	0	6	0	0	6	8,429	24	0	82
Kansas	358	175	36	147	1,295,209	4	0	57	8	3	46	235,397	15	1	373
Kentucky	101	41	8	52	124,590	0	0	19	2	0	17	20,243	60	2	218
West	93	41	0	52	108,866	0	0	19	2	0	17	20,243	52	2	130
East	8	0	8	0	15,724	0	0	0	0	0	0	0	8	0	88
Louisiana	303	159	30	114	2,446,574	0	13	53	11	7	35	555,351	0	0	471
North	101	53	10	38	361,831	0	0	10	1	0	9	49,524	0	0	126
South	143	75	12	56	1,497,404	0	12	35	8	5	22	400,542	0	0	252
Offshore	59	31	8	20	587,339	0	1	8	2	2	4	105,285	0	0	93
Michigan	37	11	0	26	104,435	2	0	18	1	0	17	44,926	26	0	91
Mississippi	25	8	1	16	157,011	0	0	11	1	0	10	61,926	0	0	39
Montana	20	11	0	9	125,071	0	0	7	0	0	7	44,032	9	0	53
Nebraska	59	24	0	35	339,811	0	0	32	3	0	29	181,202	1	0	57
West	58	24	0	34	337,221	0	0	32	3	0	29	181,202	0	0	57
East	1	0	0	1	2,590	0	0	0	0	0	0	0	1	0	0
Nevada	1	0	0	1	1,465	0	0	1	0	0	1	1,465	0	0	3
New Mexico	144	72	47	25	610,470	0	1	20	6	1	13	111,767	1	0	197
Northwest	63	12	44	7	253,564	0	0	10	4	1	5	47,223	0	0	76
Southeast	81	60	3	18	356,906	0	1	10	2	0	8	64,544	1	0	121
New York	†111	54	0	57	111,000	57	0	0	0	0	0	0	111	0	48
North Dakota	19	12	0	7	129,175	0	0	7	0	0	7	28,935	0	1	29
Ohio	88	46	12	30	223,985	9	0	0	0	0	0	0	84	0	148
Oklahoma	480	292	19	169	1,704,984	25	11	50	8	2	40	234,275	64	18	789
Pennsylvania	†263	93	73	97	603,365	84	0	5	0	3	2	38,389	252	11	88
South Dakota	3	0	0	3	11,676	0	0	3	0	0	3	11,676	0	0	6
Texas	1,531	906	68	557	6,546,334	5	12	387	47	14	326	1,822,644	80	10	1,371
Dist. 1	71	39	3	29	193,602	0	0	26	1	2	23	71,891	4	0	45
Dist. 2	41	16	12	13	269,727	0	1	15	1	4	10	115,425	0	0	41
Dist. 3	127	62	11	54	877,386	0	9	39	5	3	31	315,352	0	0	138
Dist. 4	82	38	16	28	464,609	0	0	25	4	3	18	148,020	0	0	79
East	86	43	13	30	500,196	0	2	25	0	1	24	144,624	0	2	62
Dist. 7-B	216	107	1	108	689,700	2	0	80	10	1	69	248,483	26	1	128
West	519	362	2	155	2,512,224	0	0	98	11	0	87	548,352	35	5	650
Dist. 9	332	199	1	132	837,488	3	0	78	15	0	63	219,037	15	2	111
Dist. 10	57	40	9	8	201,402	0	0	1	0	0	1	11,460	0	0	117
Utah	14	2	1	11	65,153	0	0	12	0	1	11	56,399	0	0	52
Washington	1	0	0	1	5,980	0	0	1	0	0	1	5,980	0	0	1
West Virginia	43	3	36	4	114,399	0	0	1	0	1	0	6,144	40	0	224
Wyoming	64	27	2	35	305,218	0	0	24	2	0	22	157,499	3	0	89
Total Mar. 1957	4,096	2,134	345	1,617	16,516,546	187	38	832	*95	34	703	4,123,263	810	55	5,312
Total Feb. 1957	4,007	2,233	301	1,473	16,910,756	51	11	917	113	43	761	4,377,566	492	45	4,942
Cum. 1957	13,261	7,034	1,007	5,220	54,920,486	299	95	3,085	376	127	2,582	15,028,458	2,018	138	....
Cum. 1956	13,930	7,678	913	5,339	57,392,000	....	....	3,088	438	92	2,558	14,876,000	....	....	....
Western Canada	315	203	13	99	1,469,372	....	....	94	11	5	78	448,082	....	....	....
Alberta	167	100	9	58	871,687	....	....	57	6	4	47	287,797	....	....	....
Saskatchewan	109	80	1	28	477,229	....	....	23	4	0	19	95,136	....	....	....
Manitoba	28	22	0	6	61,517	....	....	5	0	0	5	14,785	....	....	....
British Columbia	9	1	3	5	51,835	....	....	7	1	1	5	43,260	....	....	....
N.W.T.	2	0	0	2	7,104	....	....	2	0	0	2	7,104	....	....	....
Canada Cum. 1951	769	509	40	220	3,529,114	....	....	213	19	17	177	973,510	....	....	....
Alberta cum.	394	247	28	119	2,040,570	....	....	121	8	14	99	609,655	....	....	....
Saskatchewan cum.	270	204	1	65	1,182,189	....	....	59	9	0	50	234,390	....	....	....
Manitoba cum.	79	56	0	23	175,969	....	....	17	0	0	17	47,596	....	....	....
B. C. cum.	24	2	11	11	123,282	....	....	14	2	3	9	74,765	....	....	....
N.W.T. cum.	2	0	0	2	7,104	....	....	2	0	0	2	7,104	....	....	....

*Incl. 12 cond. disc.: S. La. 4, La. offshore 1, Okla. 3, Texas (3) 4. †Incl. compl. for first 3 months.
Note: Ser. (service wells); C. (cond. wells); C.T. (cable-tool compl.); D.D. (O.W.D.D.); Act. op. (active operations).

fully determine the full worth of these two discoveries. More testing is required at the two wells, and other wells must go down before it can be proved if the two areas are contiguous. Both wells are due production tests after the spring breakup. It is hoped that evaluation won't lag as long as it did at Red Earth. The area around the discoveries is rugged, but not full of the muskeg that bothers Red Earth operators.

Followup drilling should get under way this spring and summer. Home et al have two more tests planned in the two areas—one at 16-12 Virginia Hills, 6 miles northeast of the original strike, and one 6 miles southwest of Swan Hills. These tests will be the most closely scrutinized wildcats in western Canada in the next few months.

Coast-to-coast news . . . Although Virginia Hills and Swan Hills discoveries captured the exploratory scene in March, there were significant strikes in other areas of Canada—a new oil field in British Columbia, a Rocky Mountain discovery in southwestern Alberta, and a new gas field of importance in the Quebec Lowlands.

. . . More oil for B.C. One new field and one more indicated oil strike highlight March exploration in British Columbia.

Hudson's Bay Oil & Gas Co., Ltd.,

Breakdown of Footage for March 1957

	Field footage			Wildcat footage		
	Oil	Gas	Dry	Oil	Gas	Dry
Alabama	80,223	0	0	0	0	14,021
Arkansas	135,144	2,520	52,055	2,801	4,895	22,503
California	312,257	15,264	35,514	19,428	0	149,552
Colorado	32,065	11,301	33,557	12,517	0	179,553
Florida	0	0	0	0	0	4,755
Georgia	0	0	0	0	0	4,151
Illinois	103,860	2,048	134,352	0	425	81,983
Indiana	12,478	837	22,153	0	0	8,429
Kansas	560,977	131,785	367,050	30,680	15,910	188,807
Kentucky, W.	37,428	0	51,195	1,387	0	18,856
Kentucky, E.	0	15,724	0	0	0	0
Louisiana	1,084,177	170,242	636,804	139,119	88,738	327,494
North	171,861	25,030	115,416	9,008	0	40,516
South	644,289	85,562	367,011	100,251	61,293	238,998
Offshore	268,027	59,650	154,377	29,860	27,445	47,980
Michigan	33,264	0	26,245	1,670	0	43,256
Mississippi	54,693	4,495	35,897	6,772	0	55,154
Montana	74,599	0	6,440	0	0	44,032
Nebraska, W.	127,784	0	28,235	17,564	0	163,638
Nebraska, E.	0	0	2,590	0	0	0
Nevada	0	0	0	0	0	1,465
New Mexico	256,549	175,857	66,297	48,135	6,302	57,330
Northwest	36,740	164,907	4,694	21,047	6,302	19,874
Southeast	219,809	10,950	61,603	27,088	0	37,456
New York	54,000	0	57,000	0	0	0
North Dakota	100,240	0	0	0	0	28,935
Ohio	126,251	36,068	61,666	0	0	0
Oklahoma	969,182	102,956	398,571	61,607	14,037	158,631
Pennsylvania	159,776	222,068	183,132	0	22,743	15,646
South Dakota	0	0	0	0	0	11,676
Texas	3,533,760	313,335	876,595	258,943	95,751	1,467,950
Dist. 1	95,511	10,170	16,030	1,357	17,720	52,814
Dist. 2	87,444	51,800	15,058	4,755	26,367	84,303
Dist. 3	348,639	69,625	143,770	58,216	21,110	236,026
Dist. 4	183,364	67,520	65,705	25,718	24,984	97,318
East	251,337	78,828	25,407	0	4,913	139,711
Dist. 7-B	329,916	0	111,301	47,677	657	200,149
West	1,640,836	9,564	313,472	65,395	0	482,957
Dist. 9	453,005	1,960	163,486	55,825	0	163,212
Dist. 10	143,708	23,868	22,366	0	0	11,460
Utah	8,754	0	0	0	5,706	50,693
Washington	0	0	0	0	0	5,980
West Virginia	6,199	94,266	7,790	0	6,144	0
Wyoming	106,240	14,553	26,926	12,731	0	144,768
Total U. S.	7,969,900	1,313,319	3,110,064	613,354	260,651	3,249,258
Western Canada	898,686	32,275	90,329	31,689	27,296	389,097
Alberta	511,595	20,225	52,070	10,624	20,327	256,846
Saskatchewan	342,506	3,475	36,112	16,873	0	78,263
Manitoba	44,585	0	2,147	0	0	14,785
British Columbia	0	8,575	0	4,192	6,969	32,099
N.W.T.	0	0	0	0	0	7,104

and Union Oil Co. of California opened the province's second definite oil field 60 miles northeast of Fort St. John and 50 miles northwest of nearest oil production at Boundary Lake. The 1 Milligan Creek, in northeastern British Columbia, flowed 15 bbl. of oil in ½ hour from basal Triassic.

The indicated oil discovery is the Northern Foothills Agreement Group's 6 Boundary Lake, 17 miles north-northwest of Boundary Lake Triassic oil field, the province's only definite oil field. Production tests at this possible third oil field for British Columbia have been delayed by impossible terrain conditions.

Oil production in British Columbia is just 1 year old. The province's first oil discovery was made last year at Boundary Lake. Later, oil was found inside Fort St. John gas field. This year should be an important oil exploratory and development year for the region.

. . . Gas in the Rockies. Shell Oil Co. opened a gas-distillate field at Waterton Park in the Canadian Rockies of southwestern Alberta. Production is from the Mississippian. The discovery opens the second inside-Rockies field in this region, the other being at Savanna Creek.

. . . Gas in French Canada. Bald Mountain Oil Co., Ltd., has what is reported to be the first substantial gas discovery in the Quebec Lowlands of eastern Canada. The Quebec strike, near Batiscan, flowed more than 10,000 M.c.f. of gas per day on two drill-stem tests at about 3,000 ft. in the Trenton lime-Ordovician.

Back in the States

Not all of the exploratory news came from Canada in March. Important discoveries in the United States opened new provinces, gave strength to others, and revived activity in older areas.

In Montana . . . A Lodgepole (lower part of the Madison - Mississippian group) oil discovery in the "Forgotten Corner of the Rockies," the Sweetgrass arch country of northwestern Montana, could have a tremendous impact upon exploration in this region.

The significant hit is Flank Oil Co.'s 1 Bugbee in Glacier County, 4 miles west of Cut Bank field. The wildcat flowed 25 bbl. of oil in 1 hour on drill-stem test 4,625-43 ft. The Bugbee discovery is the first well in this part of Montana to produce commercial oil from the Lodgepole - Lower Mississippian section. It opens a whole new wildcat target for an area that has slipped into exploratory solitude in the last few years. There has been little drilling below the top of the Madison lime in northwestern Montana.

In Wyoming . . . A rare Pennsylvanian test in the northeastern part of the Powder River basin flowed oil at the rate of 28 bbl. per hour on ¾-in. choke to startle Wyoming operators.

True Oil Co. B-6 Burrows in Donkey Creek field, Crook County, is the first well in this field to go below Cretaceous rocks. It is one of the few holes ever to take a look at the Pennsylvanian. The only pre - Cretaceous production in the northern Powder River basin is at Adon, and Mitchell Creek fields. Neither of these fields amounted to much. Major production in Wyoming comes from the Pennsylvanian, and it is a good producer in the southern and southwestern ends of the Powder River basin. The Crook County discovery may be a signal for another look at Pennsylvanian possibilities in the northeastern Powder River area.

In the Paradox . . . Activity continued brisk and successful in the Aneth region of southeastern Utah. The March score was:

. . . Davis Oil Co. opened East Desert Creek field at 1 Navajo A. The well flowed 1,680 bbl. of oil per day from Paradox-Pennsylvanian. Location is at the east end of a triangle formed by North Desert Creek and Desert Creek fields. Two offsets quickly followed.

. . . Pan American Petroleum Corp. opened the westernmost production in the basin at 1 Featherstone about 3 miles west of Recapture Creek field. The well flowed 273 bbl. per day on 20/64-in. choke from Pennsylvanian.

. . . The important confirmation well to new West Desert Creek field in San Juan County was completed flowing 210 bbl. of oil per day on 14/64-in.

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Breakdown of Field Wells Drilled in March 1957, by Depth

	0-1,250 (A)			1,250-2,500 (B)			2,500-3,750 (C)			3,750-5,000 (D)			5,000-7,500 (E)			7,500-10,000 (F)			10,000-12,500 (G)			12,500-15,000 (H)			15,000 and over (I)		
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry
Alabama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0
Arkansas	2	0	1	40	0	1	5	1	11	5	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
California	6	0	1	8	0	0	29	0	2	22	2	2	6	1	0	4	0	1	1	0	1	1	0	0	0	0	0
Colorado	0	0	0	0	0	1	0	0	0	2	0	2	4	2	4	0	0	0	0	0	0	0	0	0	0	0	0
Illinois	4	3	8	13	0	18	24	0	32	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Indiana	1	1	13	6	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kansas	0	0	0	25	1	7	99	12	54	40	16	35	3	4	5	0	0	0	0	0	0	0	0	0	0	0	0
Kentucky	31	2	15	6	5	13	2	1	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West	31	0	15	6	0	13	2	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East	0	2	0	0	5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Louisiana	3	2	1	27	4	9	8	3	12	14	0	5	15	3	9	36	4	9	34	3	21	9	2	10	2	2	3
North	3	2	1	27	4	7	7	3	11	7	0	4	5	1	3	1	0	1	2	0	2	0	0	0	0	0	0
South	0	0	0	0	0	1	1	0	1	5	0	1	7	0	3	20	2	5	26	2	12	6	1	8	2	2	3
Offshore	0	0	0	0	0	1	0	0	0	2	0	0	3	2	3	15	2	3	6	1	7	3	1	2	0	0	0
Michigan	0	0	0	3	0	3	4	0	4	1	0	1	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0	0	0	0	0	1	0	3	0	6	4	0	0	0	0	0	0	0	0	0	0	0
Montana	0	0	0	0	0	0	3	0	2	1	0	0	2	0	0	5	0	0	0	0	0	0	0	0	0	0	0
Nebraska	0	0	0	0	0	0	0	0	1	3	0	2	18	0	3	0	0	0	0	0	0	0	0	0	0	0	0
West	0	0	0	0	0	0	0	0	0	3	0	2	18	0	3	0	0	0	0	0	0	0	0	0	0	0	0
East	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Mexico	1	0	2	10	10	1	19	20	2	26	6	3	7	8	0	0	2	3	2	0	1	1	0	0	0	0	0
Northwest	0	0	1	1	10	0	0	18	0	1	5	1	6	8	0	0	2	0	0	0	0	0	0	0	0	0	0
Southeast	1	0	1	9	0	1	19	2	2	25	1	2	1	0	0	0	0	3	2	0	1	1	0	0	0	0	0
New York	54	0	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Dakota	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0
Ohio	7	2	8	2	1	8	36	3	14	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oklahoma	23	0	13	95	2	43	83	2	42	40	0	16	21	11	11	16	2	2	5	0	2	1	0	0	0	0	0
Pennsylvania	93	2	85	0	62	1	0	6	7	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Texas	70	0	31	176	4	65	198	10	32	164	6	46	171	19	36	57	11	15	17	4	6	6	0	0	0	0	0
Dist. 1	10	0	0	11	0	4	9	0	1	6	0	1	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Dist. 2	0	0	0	0	0	0	2	2	1	4	2	1	6	0	1	3	3	0	0	1	0	0	0	0	0	0	0
Dist. 3	3	0	3	4	0	0	3	0	0	12	1	5	14	1	6	17	4	8	4	2	1	0	0	0	0	0	0
Dist. 4	2	0	0	1	0	2	7	1	0	2	2	1	19	7	4	3	3	3	0	0	0	0	0	0	0	0	0
East	0	0	0	3	0	2	0	0	0	7	1	2	28	10	2	5	1	0	0	0	0	0	0	0	0	0	0
Dist. 7-B	12	0	11	29	0	8	7	0	5	24	0	9	25	0	6	0	0	0	0	0	0	0	0	0	0	0	0
West	9	0	3	40	0	12	114	1	13	81	0	21	62	1	10	26	0	4	13	0	5	6	0	0	0	0	0
Dist. 9	34	0	14	85	1	33	24	0	10	28	0	6	13	0	6	0	0	0	0	0	0	0	0	0	0	0	0
Dist. 10	0	0	0	3	3	4	32	6	2	0	0	0	2	0	1	3	0	0	0	0	0	0	0	0	0	0	0
Utah	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West Virginia	0	2	0	3	16	4	0	11	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wyoming	0	0	8	5	0	1	7	0	0	7	0	1	3	2	3	3	0	0	0	0	0	0	0	0	0	0	0
Total U. S.	295	14	243	419	105	180	518	69	222	328	43	116	257	50	78	136	19	31	66	7	31	18	2	10	2	2	3
Western Canada	0	0	0	24	2	1	8	3	5	95	1	10	57	1	4	8	1	1	0	0	0	0	0	0	0	0	0
Alberta	0	0	0	2	2	0	5	1	2	22	1	4	57	0	4	8	1	1	0	0	0	0	0	0	0	0	0
Saskatchewan	0	0	0	0	0	0	3	1	3	73	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manitoba	0	0	0	22	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
British Columbia	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Breakdown of Wildcats Drilled in March 1957, by Depth

	0-1,250 (A)			1,250-2,500 (B)			2,500-3,750 (C)			3,750-5,000 (D)			5,000-7,500 (E)			7,500-10,000 (F)			10,000-12,500 (G)			12,500-15,000 (H)			15,000 and over (I)		
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry
Alabama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
Arkansas	0	0	1	0	0	5	1	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
California	0	0	1	1	0	0	0	0	9	0	0	3	0	0	6	2	0	4	0	0	3	0	0	0	0	0	0
Colorado	0	0	1	0	0	0	0	0	0	0	0	15	2	0	18	0	0	0	0	0	1	0	0	0	0	0	0
Florida	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Georgia	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Illinois	0	1	4	0	0	12	0	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Indiana	0	0	2	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kansas	0	0	0	0	0	1	5	0	16	3	1	22	0	2	7	0	0	0	0	0	0	0	0	0	0	0	0
Kentucky	2	0	9	0	0	8	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West	2	0	9	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Louisiana	0	0	0	0	0	0	0	0	4	0	0	2	0	0	4	2	2	7	3	1	9	3	3	8	3	1	1
North	0	0	0	0	0	0	0	0	4	0	0	2	0	0	2	1	0	1	0	0	0	0	0	0	0	0	0
South	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	6	3	1	7	2	1	6	2	1	1
Offshore	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	2	1	0	0
Michigan	0	0	0	1	0	10	0	0	4	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mississippi	0	0	0	0	0	2	0	0	0	0	0	2	1	0	4	0	0	2	0	0	0	0	0	0	0	0	0
Montana	0	0	0	0	0	0	0	0	0	0	0	2	0	0	4	0	0	1	0	0	0	0	0	0	0	0	0
Nebraska	0	0	0	0	0	0	0	0	1	0	0	6	3	0	22	0	0	0	0	0	0	0	0	0	0	0	0
West	0	0	0	0	0	0	0	0	1	0	0	6	3	0	22	0	0	0	0	0	0	0	0	0	0	0	0
East	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nevada	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Mexico	0	0	0	0	0	4	0	0	4	1	0	2	3	1	0	0	0	2	0	0	1	2	0	0	0	0	0
Northwest	0	0	0	0	0	2	0	0	1	1	0	1	3	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Southeast	0	0	0	0	0	2	0	0	3	0	0	1	0	0	0	0	0	1	0	0	1	2	0	0	0	0	0
North Dakota	0	0	0	0	0	0	0	0	4	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Ohio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oklahoma	0	0	3	0	0	10	1	0	9	0	0	7	3	2	7	3	0	2	0	0	0	0	0	0	0	0	0
Pennsylvania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	1	0	0
South Dakota	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Texas	1	1	27	7	0	76	3	1	52	15	1	44	11	5	76	5	6	34	4	0	13	0	0	4	1	0	0
Dist. 1	0	0	8	1	0	9	0	0	1	0	0	2	0	0	3	0	2	0	0	0	0	0	0	0	0	0	0
Dist. 2	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	2	9	0	0	0	0	0	0	0	0	0
Dist. 3	0	0	1	0	0	1	0	0	0	0	0	1	0	3	10	2	0	13	2	0	4	0	0	1	1	0	0
Dist. 4	0	0	0	0	0	1	0	0	3	1	0	2	1	1	10	2	2	1	0	0	1	0	0	0	0	0	0
East	0	0	1	0	0	1	0	0	1	0	1	5	0	0	11	0	0	4	0	0	1	0	0	0	0	0	0
Dist. 7-B	0	1	7	1	0	27	1	0	19	4	0	10	4	0	6	0	0	0	0	0	0	0	0	0	0	0	0
West	0	0	1	1	0	8	1	0	17	4	0	17	2	0	28	1	0	7	2	0	6	0	0	3	0	0	0
Dist. 9	1	0	9	4	0	29	1	0	11	5	0	7	4	0	7	0	0	0	0	0	0	0	0	0	0	0	0
Dist. 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Utah	0	0	2	0	0	2	0	0	1	0	0	0	0	1	5	0	0	1	0	0	0	0	0	0	0	0	0
Washington	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
West Virginia	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Wyoming	0	0	1	0	0	1	0	0	1	0	0	4	2	0	10	0	0	4	0	0	1	0	0	0	0	0	0
Total U. S.	3	2	51	9	0	137	10	1	129	19	3	116	25	12	166	12	11	61	7	1	30	5	3	12	5	1	1
Western Canada	0	0	0	0	1	6	1	1	19	6	1	23	1	1	19	2	0	8	1	1	3	0	0	0	0	0	0
Alberta	0	0	0	0	1	2	0	1	10	2	1	11	1	0	16	2	0	7	1	1	1	0	0	0	0	0	0
Saskatchewan	0	0	0	0	0	1	1	0	4	3	0	11	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0
Manitoba	0	0	0	0	0	1	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
British Columbia	0	0	0	0	0	1	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
N.W.T.	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

choke. Production is from Hermosa-Pennsylvanian (Desert Creek zone).

In California . . . Ventura County's deep Fillmore field was extended ½ mile east of nearest production by Richfield Oil Corp., bringing the productive limits of the field less than ½ mile from the town of Fillmore.

Lyle Warner opened a new producing county for California at 1 G-G in Riverside County. The well made 40-50 bbl. per day.

In New Mexico . . . The Gallup sand oil play in the San Juan basin jumped back into the exploratory scene after a period of relative quiet. The area received two important Gallup discoveries during the month—one at El Paso 1-F Sullivan, 6 miles northeast of Bisti, the other at Lion Oil Co. 1 Atlas, 13 miles southeast of Bisti. The El Paso well made 525 bbl. per day, the Lion well 110 bbl.

. . . Southeast. Southeast New Mexico developments included the rapidly expanding area west and southwest of Lovington in Lea County, where Tennessee Gas Transmission, Humble, Ohio, Sinclair, and Skelly have opened a series of new areas, established new pays, and extended fields. Pays range from the Permo-Pennsylvanian to the Devonian and depths to over 13,000 ft. This is an area where very few wells have ever gone below 5,000 ft.

Northern Lea, until recently the most active exploration area, has again come up with good shows in undrilled areas. Ten miles north of Lovington, Phillips 1 Austin, deep wildcat, was reporting gas flows from the Mississippian, and oil shows from the Devonian. Both zones were below 13,000 ft.

In Oklahoma . . . Three producers and three new locations around the new Southeast Stockholm field discovery well in Harper County, northwestern Oklahoma, make this one of the most attractive wildcat areas in the state. Gas and oil production is being tapped in the lower Tonkawa-Pennsylvanian.

In Texas . . . Texas developments included a new producing county, continued activity in older areas of West Texas, and an inshore-offshore drilling spree in Galveston.

Pan American Petroleum Corp. 1 Brandon is the first oil well in Motley County on the Matador uplift, an east-west feature separating the Midland and Palo Duro basins of West and Northwest Texas. The discovery well pumped 232 bbl. of oil per day from Wolfcamp or Permo-Pennsylvanian. This entire region is one of Texas' last exploratory frontiers and has had little exploration. There are only two fields anywhere near—one at Wilie in Cottle County to the east, and one at Floydada in Floyd County to the west.

In West Texas the steady search in old areas still comes up with results. Halley field in southern Winkler County gained its third deep pay (Ellenburger) at a Pan American well that flowed 344 bbl. per day. The new pay is the fourth in the field, plus an extension to producing limits.

Another field to add a deep zone is Keystone, South field in Winkler County. Regular pay is the Tubb of Lower Permian age. Gulf Oil Corp. made a good flowing well on the northwest flank of the field from Devonian pay at 8,600 ft.

There is a noticeable stepup in exploration in Galveston and its associated bays on the Gulf Coast. There are more than 15 active operations in bay waters and 6 new discoveries opened this year plus five late last year.

In North Louisiana . . . The most significant wildcat discovery thus far this year in the area is Olin Oil & Gas Corp.'s 1-J Olin Unit Smackover oil well in old Monroe Gas field, Union Parish. The well flowed 280 bbl. of oil per day. Nearest similar production is 24 miles west at Bernice field in the western part of the parish.

EXPLORATION

APPALACHIAN

PENNSYLVANIA

In Mount Pleasant Township, Westmoreland County, Southwest Pennsylvania, Peoples Natural Gas Co. has started operations in a new deep wildcat. It is 1-4089 M. I. Keck, elevation 1,840 ft., Donegal Quadrangle, 5.22 miles south of latitude 40 degrees 15 minutes and 0.48 mile west of longitude 79 degrees 25 minutes.

● In White Township, Indiana County, J. C. Walker 1 Appalachian Coal Co., drilling at 735 ft., encountered shallow gas gaging 1,032,000 cu. ft.

● In Armstrong Township, James Drilling Co. is drilling two wells and clearing location for No. 3 on D. M. Clawson lands.

WEST VIRGINIA

In Edray district, Pocahontas County, West Virginia, Logan Gas Development Co. 1 Cherry River Boom & Lumber Co., elevation 3,432 ft., reached a depth of 4,504 ft., and shut down. No decision has been made as to further attempts to make a producer out of this well.

OHIO

A short extension to Fallsburg pool was completed by Allen Willey 1 on G. B. Welling in Section 24, Fallsbury Township, Licking County. Clinton sand at 2,883-2,938 ft. was gaged 16 bbl. oil with show of gas natural and 75 bbl. oil in 24 hours after fracture.

● Monroe-Coshocton pool in Monroe Township, Coshocton County was extended by three additional completions: Ditch et al 1 S. Markley, Section 2, found the Clinton at 3,550-3,623 ft., 1 bbl. oil and show gas natural. Well made 25 bbl. oil and 285,000 cu. ft. gas after fracture. Ditch et al 4 C. B. McKelvey, Section 1, found the Clinton at 3,313-52 ft. with show oil and 63,000 cu. ft. gas natural. Well made 5 bbl. oil and 84,000 cu. ft. gas after fracture. Natol 1 D. Hoffstettler in Section 7 found the Clinton at 3,449-55 ft. with show of oil and 30,000 cu. ft. gas natural. Well made 15 bbl. oil and 536,000 cu. ft. gas after fracture.

CALIFORNIA

Texaco Gets Another Big Honor Rancho Well

The Texas Co. brought in 17 Honor Rancho flowing 1,131 bbl. daily of 35.4°-gravity crude from an interval at 9,673-10,038 ft. The well was producing through a 21/64-in. choke. It is in the southeast pool activity on the east flank.

Deep Test Slated For South Mountain

The Texas Co. announced it would drill a 15,000-16,000 ft. wildcat on the north flank of South Mountain field, Ventura County. This well is particularly significant as the operator states it is aiming for Miocene and Eocene

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formations believed to be at that depth. If this proves to be the case, it will create a unique situation in that the area now has Miocene production at 4,400 ft. and Pliocene production at 7,000 ft. plus. This results from the steeply overturned condition of the Oakridge uplift.

West Montalvo Deep Test Plugged Back

Standard Oil Co. of California has plugged back 4 McGrath in West Montalvo field, Ventura County, from 17,422 ft. to 16,307 ft. and is testing an interval at that depth. This well fell short of the field mark by about 200 ft. The field depth record holder was a dry hole drilled to 17,696 ft. 2 miles north of the present test.

CANADA

BRITISH COLUMBIA

West Coast Province Takes Canadian Lead

The northeastern sector of British Columbia which is fast becoming a "king pin" in western Canada's gas and oil industry was the source of the news highlights in this sector during the past 7 days. Initially it was reported that the oil production in that province had reached a new-record level which is fast overtaking the output of Imperial Oil's Northwest Territories wells; then, the Imperial-Pacific Petroleums, Ltd., team, currently carrying out an exploratory drilling program in the Boundary Lake area of B.C. announced that another one of those tests had indicated oil production in the same zone as those in the field, 8 miles to the north; and finally, that province's Government announced that a company, Act Oils, Ltd., which is controlled by the Canada Southern Petroleums, Ltd., group, had applied for a permit to construct an oil pipeline from the Peace River district in northeastern British Columbia to the Bella Coola tidelands on the coast, a distance of approximately 400 miles.

The regular monthly report of the B.C. Government reported that the 12 oil wells in that province combined for a total output of 35,426 bbl. during the second month of this year or 151 bbl. per day better than during the initial month of 1957.

● Boundary Lake, the province's major oil producing area and only defined field within the West Coast province, had six of the wells turn out 20,294 bbl. of the total while the Imperial-Pacific 1 Boundary Lake discovery hole, 5 miles southwest of the field, produced 1,198 bbl. during its first month on production. The balance, or five wells in the Fort St. John area, yielded 13,934 bbl. for the month of February.

● The new discovery in the Boundary Lake area, Imperial-Pacific 1-23 Alces, on LSD 1, 23-84-14w6, lies 4½ miles south of the Imperial-Pacific 11-10 Boundary Lake (formerly 1 Boundary Lake) oil discovery hole which lies 5 miles southwest of oil production in the main field area. The release on the well from Imperial Oil stated: "Production casing has been set and perforated in the Triassic to evaluate an oil show in that horizon. Production tests have been suspended until after the road ban in the area has been lifted." Thus it is not known at the present time if the well will make a commercial producer, although rumors circulating infer that chances of success appear extremely good.

● Act Oils, Ltd., the affiliate of Canada Southern Petroleums was reported to have made application to the British Columbia Government for right to build an oil pipeline from the Peace River district of northeastern British Columbia to the coastal town of Bella Coola. The pipeline, it was reported by officials of Canada Southern, would initially handle a capacity of 100,000 bbl. per day with an extended throughput estimated in the 400,000 bbl. a day mark. However, feeling in the oil circles is that the proposal of the pipeline is somewhat premature as the reserves in that sector of Canada are far below those needed to make the artery economically possible. The route proposed by Act Oils would not present any engineering problem according to information received. The coast site also affords a suitable shipping location for crude dispatch either north or south. An engineering study of the route is being made at the present time by Dutton-Williams, Ltd.

ILLINOIS BASIN

ILLINOIS

New Interest Reported At South Raleigh Pool

New development activity is reported in Saline County's South Raleigh pool, 5 miles north of Harrisburg and 7 miles west of Eldorado. This was the state's busiest county 2 years ago. Carter Oil Co. and John Buchman-C. E. O'Neal & Co. have started the new play.

Carter's 1 Bruno DeGiacinto, NE NW SW 8s-6e, found 2,800 ft. of clean oil on a drill-stem test at 2,852-57 ft. in the Aux Vases. The operator has set casing.

INDIANA

Drilling Interest Revived Near Princeton

The area 4 miles southwest of Princeton in Gibson County is currently one of the busiest in the basin. Two good oil wells were completed for 200 bbl. per day on pump. Basin Oil Co. 1 Woods-Hutchinson, SE NW SW 2s-11w, pumped 200 bbl. per day from the Benoist at 2,187-2,204 ft.; Harris Drilling Co. 1 Otis Emerson, NW SW SW, is also a Benoist producer at 2,198-2,211 ft.

LOUISIANA

SOUTH LOUISIANA

Oakley Gets First Oil In New Pay Discovery

First successful confirmation well for Assumption Parish's Oakley field, discovered in March 1955, is being completed as the initial oil producer in the area. Its pay is nearly 2,800 ft. deeper than that of the discovery well, productive of gas and condensate. Since the discovery well was completed, two dry holes have been drilled.

The new oil discovery is by North Central Oil Co. and Rowan Drilling Co. at their 1 Williams, in 39-14s-14e, west of the area's gas-condensate discovery-well. The well, drilled to 13,219 ft., is perforated at 12,588-12,600 ft. It flowed at the rate of 211 bbl. of 26.9°-gravity oil per day through ⅛-in. choke. Pressure was 1,425 psi. and gas-oil ratio 1,440 cu. ft. per barrel.

The area's discovery well, and the two successive dry holes were drilled by Hassie Hunt Trust. Dry holes were southwest and south of the first well.

Dual-Zone Producer Opens Two More Pays at Ridge

Sunray Mid-Continent Oil Co.'s latest completion in its Ridge field, south of Duson, in southern Lafayette Parish, gives the area two additional deep pay zones. It is a dual-zone gas-condensate producer. Both zones, one perforated at 10,390-10,404 ft. and the other at 10,130-36 ft., are shallower than either of the two other zones already opened.

Sunray's new well is its 1 Smith, in 17-10s-3e. From its deeper pay, it flowed 45 bbl. of 48°-gravity condensate with 2,500,000 cu. ft. of gas per day while on 13/64-in. choke. Flowing pressure was 3,200 psi. Its upper pay was credited with a daily flow of 42 bbl. of 51.2°-gravity con-

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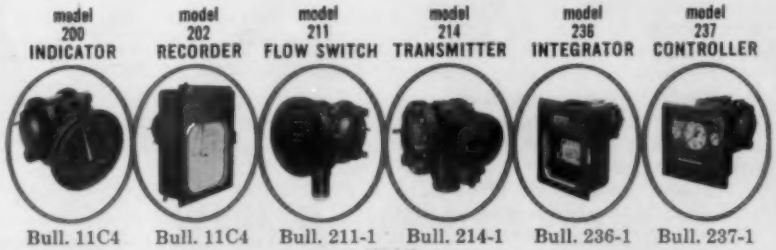

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densate, also with 2,500,000 cu. ft. of gas, on 13/64-in. choke.

This is Sunray's fourth successful well in the immediate area. Discovery well, completed in November 1955, is productive of gas and condensate at 12,158-74½ ft. The other two wells produce from 11,000-ft. sands. Two other tests have been dry.

MICHIGAN

Natural oil flow declined to point where well had to be swabbed to recover jil from the Trenton at Aurora Gasoline Co. and McClure Oil Co. 1 Rowe, SE NW NE 10-5s-3w, Scipio Township, Hillsdale County.

This diagonal northwest 20-acre offset to the Scipio Trenton oil-gas discovery, rated here last week as a successful follow-up to the discovery, flowed a total of 130 bbl. natural before well declined to a point where recovery by swabbing averaged only a half barrel an hour. Top flow rate recorded during initial test was 4 bbl. of oil an hour.

Well was ineffectively acidized with 1,000 gal. and operators announced that tubing would be pulled and well would be drilled deeper in the Trenton.

Top of Trenton was logged at 3,565 ft. Gas showed from 3,643 ft. and oil showed from 3,873 ft. Well was bottomed out for test at 3,823 ft. Top gas gage reported while drilling was being continued, was 240,000 cu. ft. at 3,726 ft. Well was short, both on gas and oil flows, of the discovery producer.

● Meanwhile, the discovery, at Clifford A. Perry 1 Houseknecht, NW SE NE 10-5s-3w, continued to flow through 5-in. casing at the rate of 6 bbl. an hour. Well, presently bottomed out at 3,833 ft., may be deepened further in Trenton Black River, to about 3,865 ft., or 300 ft. in Trenton which was topped at 3,565 ft.

OREGON

Wildcat Planned Near Portland

Sunray Mid-Continent Oil Co. and Lloyd Corporation of Los Angeles have staked location for a joint wildcat test in Multnomah County, Oregon. The well will explore a 11,000 acre lease held jointly by Sunray and Lloyd. A total depth of 5,000 ft. is planned. The decision to drill was made following a 9-hole core program conducted in the area last fall. The land block is just west of the Columbia River about 20 miles north of Portland.

ROCKY MOUNTAIN

The Outlook area of northeastern Montana's Sheridan County in the Williston basin received another location . . . Amerada Petroleum Corp. 1 Grant in NE NW 2-36n-51e. Location for the 10,000-ft. Winnipeg test is 8 miles northwest of the indicated 1 Ruegsegger discovery in C NE NE 24-36n-52e. Amerada has shut in the 1 Loucks discovery 3 miles southwest of the 1 Ruegsegger. It flowed 312 bbl. of oil and 31 bbl. of water per day from the Red River-Ordovician at 9,896-9,916 ft. The Loucks well is 4 miles southwest of the 1 Tange discovery well.

COLORADO

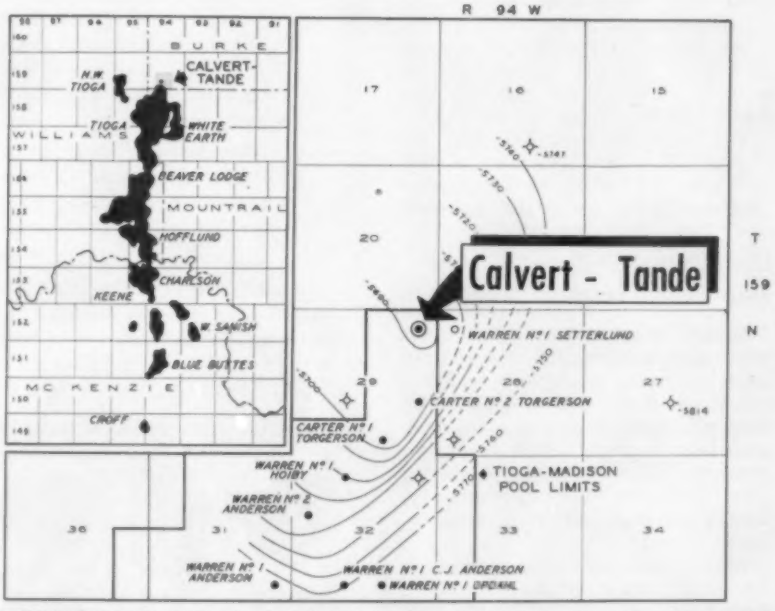
Las Animas Arch Gas Discovery Completed

D. D. Harrington completed his 1-A State in NE SW 34-19s-48w, Kiowa County, for 5,420 M.c.f. of gas per

Nesson Anticline Gets Key Well

SUCCESSFUL completion of Calvert Drilling, Inc. et al 1 Tande extends the Tioga-Madison pool ½ mile to the north. To date it is the most northerly oiler on the prolific trend that extends a distance of 50 miles. The Tande was completed for a daily production of 480 bbl. from the Madison pay interval at 8,008-28 ft. Warren Petroleum Corp. is drilling a direct 40-acre offset to the extension instead of the normal 80-acre pattern location.

The new producer logged 53 ft. of oil-stained Madison limestone, a considerably thicker pay section than is present in the direct south offset, Carter Oil Co. 2 Torgeson. The new oil well is of significance because it may prove up several additional locations on the north edge of the anticline. Marginal wells on the north edge had served to slow development drilling in this direction. The Tande, however, sheds an entirely new light on the northern limit of production on the Nesson anticline which is still not defined.



TIOGA-MADISON FIELD in North Dakota has been extended ½ mile north with successful completion of Calvert Drilling, Inc. et al 1 Tande.

day opening a new Morrow-Pennsylvanian gas-producing area in the Las Animas arch country of southeastern Colorado.

The wildcat discovery is 4½ miles northeast of gas production in the Southwest Eads area. Perforations in the Morrow were at 4,725-35 ft.

WYOMING

Gas Flow Reported at Birch Creek Well

The 1 Birch Creek Unit gas discovery Sublette County was completed by The California Co. for 2,000 M.c.f. of gas per day on 20/64-in. choke. Location of this Bear River producer is in SW NE NW 14-27n-113w.

Locations Staked in Powder River Basin

Activity in the Powder River basin is picking up considerable speed with the coming of spring. Three wildcats were staked last week . . . Brinkerhoff Drilling Co. 1 Oelkers in Weston County. Brinkerhoff 1-A Government in Weston County (the first will test the Dakota at 7,000 ft., the second likewise). Locations are 8-10 miles southeast of Raven Creek. Trigood Oil Co. will drill the 1 Harris-Simpson in Crook County, 3½ miles north of Donkey Creek field where Pennsylvanian production was recently established.

NORTH DAKOTA

Amerada Tests Silurian At Beaver Lodge Wildcat

Amerada Petroleum Corp. reported recovery of 2 bb. of oil and 129 bbl. of salt water at their deep Beaver Lodge field wildcat, the 1 Iverson-Nelson in NW SE NE 2-155n-96w, Williams County. The test was in the Silurian at 11,990-12,050 ft.

A recent test of the Ordovician-Red River at 12,696-12,784 ft. flowed 332 bbl. of condensate in 23 hours and 40 minutes on various chokes.

TEXAS

SOUTHWEST TEXAS

Deep Edwards Produces in Mula Ranch Discovery

Deep Edwards is proving productive in another McMullen County discovery. It is in the old Mula Ranch area, on the west edge of the county, 15 miles southwest of Tilden, where two lower Wilcox wells, now abandoned, have been completed. It is about 2 miles southwest of the Syndicate area where H. R. Smith completed a deep Edwards discovery-well early in 1955.

The Mula Pasture discovery is by Jupiter Oils, Inc., at its 2 South Texas Syndicate, in Section 29, H&OB Survery. Its pay, in hole drilled to 10,628 ft., is perforated at 10,530-51 ft. and 10,554-75 ft. The well is estimated good for 8,000,000 cu. ft. of gas per day, open flow. Pressure through ¼-in. choke was 1,400 psi. Shut-in pressure is 4,100 psi., top, and 4,180 psi., bottom-hole.

Location is northwest of Phillips Petroleum Co.'s Wilcox discovery well, completed in September 1952, and 1,320 ft. south of Heep Oil Corp.'s Wilcox confirming well. There has been no production in the area since August 1954.

TEXAS GULF COAST

Second Zone Opened in New Montgomery Field

Northern Montgomery County's Rosner-Anderson field, opened earlier this month by Moran Corp. with an oil discovery in Cockfield sand at 4,556-60 ft., already has its second well, com-

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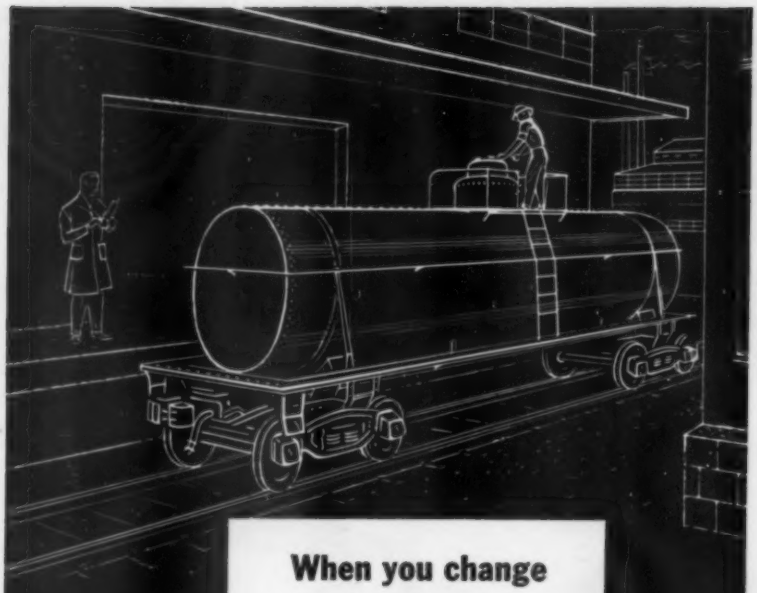

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pleted as a gasser in a slightly higher zone, perforated at 4,555-58 ft.

The gasser, 1 Rosner - Anderson, 1,250 ft. north of the oil-discovery well (2 Rosner-Anderson), was started as the initial test in the area. It passed up the indicated Cockfield pays as an exploratory test to 8,535 ft. Plugging back, it first attempted to make a well in the oil zone, perforated at 4,562-64 ft., but failed to shut off water in that pay. The present pay, although perforations are only slightly higher, is in a different zone.

In the meantime, the second well was started and drilled to the Cockfield oil zone, in which it was completed testing 121 bbl. of 32°-gravity oil per day through ⅛-in. choke. It had pressure of 850 psi. with gas-oil ratio of only 400 cu. ft. per barrel.

Moran already is below the pay zone in its third test, east offset to the oil-discovery well, and has locations for two others.

WEST TEXAS

Reef Well in Howard County Flows Oil on Drill-Stem Test

Woodson Oil Co. 1 Pauline, formerly J. E. Jones Drilling Co., had flowing oil on two drill-stem tests in Pennsylvanian reef. The well was shut in after flowing brief periods and no gage or estimate was made on the rate of flow.

On elevation of 2,355 ft., first oil shows came while testing at 7,445-56 ft. A spray of oil reached the top in 10 minutes and recovery was 760 ft. of oil. On test at 7,456-86 ft., oil reached the surface in 10 minutes, under bottom-hole flowing pressure of 2,675 psi.

A test from 7,486-7,516 ft. had gas in 3 minutes and oil in 10, with flowing pressure of 2,525 psi. The last section reported on was from 7,516-46 ft., which had oil in 19 minutes, but recovery included 550 ft. of salt water. Flowing pressure was down to 1,325 psi.

Location is in Section 57, Block 20, Lavaca Navigation Co. Survey. The well is ½ mile north of the one-well Vincent (Upper Canyon), and ¾ mile northwest of the lone producer in Vincent (Lower Canyon) field. It is separated from the latter by a dry hole and depleted producers.

Dawson County . . . Hunt Oil Co. 1 Freeman reported further flow tests from the Chester limestone (Mississippian) between 11,159-73 ft. Following an acid treatment, the well flowed 115 bbl. of oil in 17½ hours through open 2-in. tubing. Location is 9 miles southwest of Lamesa.

Crane County . . . Evans Production Corp., Dallas, 1 W. T. Dawson, southeastern Crane County wildcat, has been completed as a Devonian discovery. Potential was 480.7 bbl. of 38° oil through 1-in. choke, from perforations at 5,605-40 ft.

Location in Section 82, Block X, CCSD&RGNG Survey is 1 mile west of an 8,170-ft. Ellenburger failure and 1½ miles southwest of Crane Cowden field.

Pecos County deep test . . . Phillips Petroleum Co. 1 University "EE," scheduled to 18,500 ft., reported flows of gas while drill-stem testing in the Wolfcamp. Gas volume ranged around 158,000 cu. ft. per day, much under the 1,006 M.c.f. gaged while testing the San Andres.

Wolfcamp tests were at 10,330-10,438, 10,549-10,615 and 10,764-10,836 ft. The last test had a trace of distillate with the gas. Flowing pressure was 1,100 psi. Drilling continued below 10,884 ft.

WEST CENTRAL TEXAS

New Reef Field Has Confirmation Prospect

Fisher County's recently completed Strawn reef discovery 4½ miles southwest of Claytonville had prospects of a second well, and ½-mile southeast extension.

The second test is George R. Brown 1 Kate Davenport "A," in Section 128, Block 3, H&TC Survey. On drill-stem test in Strawn reef at 6,385-6,468 ft., open 2 hours, gas showed in 4 minutes, with a fine spray of fluid. Recovery was 300 ft. of oil, plus oil and gas-cut salt water. Flowing pressure ranged from 930-1,900 psi. The area is in the western part of Fisher County.

Location has been made for a 6,200-ft. Strawn reef wildcat by Fletcher Oil & Gas Drilling Corp., Dallas, in southwestern Fisher County. The project will be 1 Rosa Horton, located on a 160-acre tract in Section 264, Block 3, H&TC Survey. The test is 2½ miles southeast of Claytonville townsite and the same distance southeast of Claytonville field.

Nolan County . . . Dan & Jack Auld 1 George W. Parker, scheduled 7,000-ft. wildcat 1 mile southwest of Sweetwater, recovered 2,950 ft. of oil on a 4-hour drill-stem test in Cisco sand at 4,187-95 ft. Flowing pressure was 645 psi., increasing to 1,605 psi. when shut in. Nearest Cisco production is in Group field, 17 miles to the south.

Coke County . . . Plymouth Oil Co. 1 T. E. Tidwell, new-pay opener in the 1-well West Wendkirk (Crosscut sand) field 5 miles southeast of Robert Lee, has been completed as a flowing discovery. Initial potential was 174 bbl. of oil a day through ⅝-in. choke, from a Pennsylvanian detrital zone at 6,120-50 ft. Gas-oil ratio was 583:1.

Haskell County . . . A new Cook sand discovery, or long extension to present production, has been completed at Stamford Royalties 1 T. G. Hendrick Estate, 18 miles east of Stamford.

The well flowed 132 bbl. of 39° oil in 12 hours through ½-in. choke, from pay at 1,600 ft. Total depth was 1,735 ft. Gas-oil ratio was 500:1. Location is in the A. Rodrequez Survey, Subdivision 6.

WASHINGTON

King County Wildcat Set

McCulloch Oil Exploration Co. of California announced plans to drill a 5,000 ft. wildcat in SW SW 34-21n-6e in Kings County. This is in the Enumclaw area.

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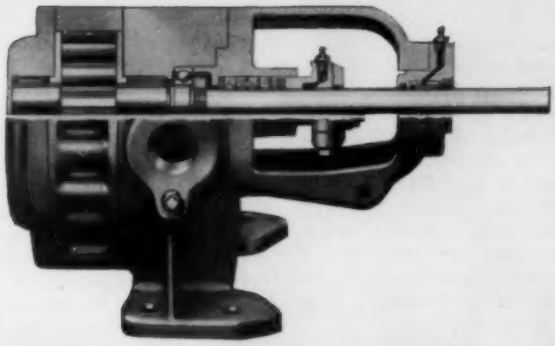

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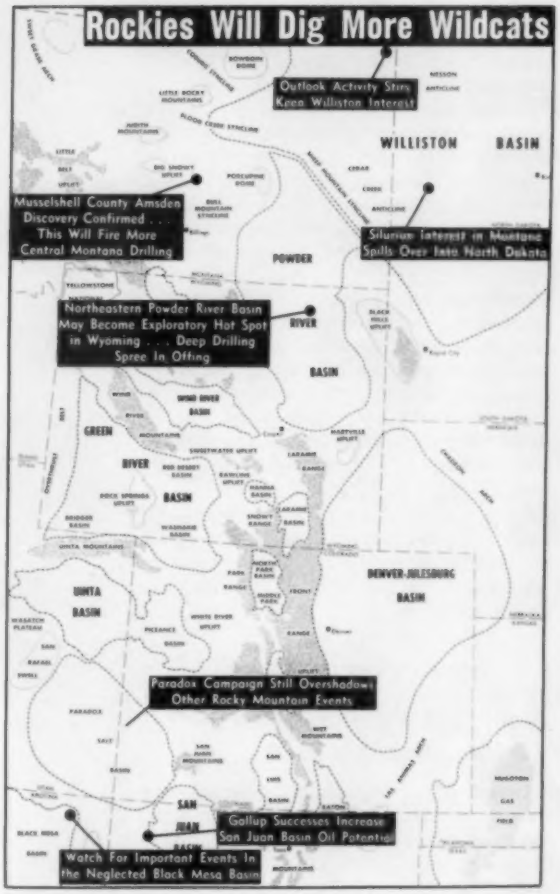
Wildcat Boom Slated for Rockies

by John C. McCaslin
District Editor

DESPITE the nation-wide lag in drilling and the continued decline in well completions, Rocky Mountain operators look for another banner exploratory and development year in this vast province. Drilling statistics through April 20 in the seven-state area, reveal a slight decline in total completions, but a healthy gain in wildcat completions. The bright part of this drilling picture is the sharp gain in oil discoveries. The only states showing losses in total completions are Colorado, Montana, and Nebraska. Substantial gains are noted in North Dakota, the San Juan basin of northwestern New Mexico, Utah, and Wyoming.

There is a definite trend toward increased wildcatting throughout the mountain states. It appears now that there will be less development wells drilled, but a substantial increase in wildcats during the remainder of 1957. The Paradox basin of southeastern Utah will continue its grasp on the lead spot in the drilling race, but there will be some hardy contenders—the San Juan basin, Central Montana, western Nebraska, the northeastern Powder River basin, and northeastern Montana and western North Dakota in the Williston basin.


Rockies Will Dig More Wildcats
Outlook Activity Stirs Keen Williston Interest
WILLISTON BASIN
Musselshell County Amsden Discovery Confirmed . . . This Will Fire More Central Montana Drilling
Silurian Interest in Montana Spills Over Into North Dakota
POWDER
Northeastern Powder River Basin May Become Exploratory Hot Spot in Wyoming . . . Deep Drilling Spree In Offing
RIVER
BASIN
GREEN
RIVER
BASIN
UINTA
BASIN
DENVER-JULESBURG
BASIN
Paradox Campaign Still Overshadows Other Rocky Mountain Events
SAN
JUAN
Gallup Successes Increase San Juan Basin Oil Potential
Watch For Important Events In the Neglected Black Mesa Basin

ROCKY Mountain operators look for another banner exploratory and development year in this vast province.

Williston . . . The year's success tale begins at the top of the map in northeastern Montana's Outlook area.

Williston's most important exploratory year began at Outlook in Sheridan County with the completion of Amerada Petroleum Corp.'s 1 Tange. This Silurian discovery was completed for 2,742 bbl. of oil per day, firing new enthusiasm for the prospects of this neglected Williston pay zone. The 1 Loucks confirmation well, 4 miles southwest, has recovered possible commercial shows of oil in both the Silurian and Ordovician. The third well, 1 Ruegsegger, is also an indicated discovery.

Outlook's success set off a flurry of wildcat excitement throughout northeastern Montana and it is spilling over into western North Dakota. There has been little drilling in either locale, and the rest of 1957 will see both wildcatting and reexamination of Mississippian holes throughout the area. The Silurian push in Williston may well be the most important exploratory step in this province since Beaver Lodge.

Central Montana . . . Confirmation of Texota Oil Co.'s Amsden discovery at 1 Goffena in Musselshell County by Amerada gives the Central Montana Plains its most important development of the year.

The 1 Sudan made 153 bbl. of oil per day—the discovery well made 554 bbl. per day. This is the most important Amsden news in the Rockies since Wolf Springs field was opened 25 miles southeast. The expected stepup in Amsden exploration in this area has not yet materialized, but with Goffena now confirmed, it will be coming soon.

Powder River . . . A recent Pennsylvanian discovery at Donkey Creek field in Crook County, Wyoming, forces a new look at the deep potential of the northeastern Powder River basin. True Oil Co.'s discovery of Pennsylvanian oil is the first real such strike in this area. The well is 35 miles from previous Pennsylvanian success. It is reported that True will drill confirmation attempts soon. Pennsylvanian exploration in this portion of Wyoming will be closely watched by the oil hunt-

THE ROCKY MOUNTAIN COMPLETION TALLY

	1957—through April 20				1956—through April 21			
	Total wells	Total wildcats	Oil disc.	Gas disc.	Total wells	Total wildcats	Oil disc.	Gas disc.
Colorado	289	197	11	4	343	170	6	6
Montana	94	32	2	0	101	30	5	0
Nebraska	241	130	14	0	283	151	13	0
North Dakota	90	34	4	0	68	19	5	0
San Juan basin	224	39	12	5	196	19	1	5
Utah	49	31	4	2	25	18	1	0
Wyoming	236	86	10	2	221	73	5	4
Total	1,223	549	57	13	1,237	480	36	15

Less total completions—but more wildcats, more discoveries, that's the drilling picture for the first 16 weeks of 1957. What now? More wildcats, fewer development wells expected during 1957.

ers. It is the major producing horizon at Lance Creek in the southern end of the Powder River, and is also one of Wyoming's major producers.

San Juan basin . . . Until recent weeks the Gallup sand oil play in the Bisti region of northwestern New Mexico had been logging along at a quiet pace. Discoveries and confirmations of the past 3 to 4 weeks in the area have placed this campaign back near the top of the Rocky Mountain exploratory interest agenda. Here's what put Bisti back in place:

. . . El Paso Natural Gas Co. opened a new field in 32-27n-12w on the northeast side of Bisti in a sparsely drilled strip between Bisti and Blanco. El Paso's discovery flowed 525 bbl. of oil per day from the Gallup.

. . . Sunray Mid-Continent Petroleum Corp. confirmed an earlier Anderson-Prichard Gallup discovery 6 miles southeast of the Bisti field limits. Sunray's well flowed 196 bbl. of oil in 7 hours. The discovery well only made 300 bbl. per day.

. . . Lion Oil Co. opened another Gallup pool between the southeastern-most limits of the Bisti trend and Sunray's confirmation well.

. . . Continental Oil Co. opened a small Gallup pool in Sandoval County.

The prospects for an important oil field in the Bisti region are better than ever. There are about 90 Gallup sand producers in this area. The southeastern limits of the trend are separated by 15 miles of relatively untested Gallup prospects from the Bisti field itself.

Black Mesa basin . . . Here is the newcomer to the 1957 Rocky Mountain exploratory program.

A long-awaited wildcat program was announced early in April by Kerr-McGee Oil Industries, Inc., for Arizona's northeastern corner. There has been no drilling here this year, but two gas pools were opened in 1956. The new wildcat activity will be 42 miles northeast of Holbrook in Apache County's 4-19n-26e. The Black Mesa basin is the largest untested region in the Four Corners. A discovery here would explode the already hot interest in the Four Corners.

Paradox basin . . . Two new fields and an important confirmation discovery plus widespread new locations in southeastern Utah's Paradox corner keep this basin in the eyes of the whole industry. Pan American Petroleum Corp. established the westernmost production in the Aneth trend, while Davis Oil Co. opened East Desert Creek field.

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Successful Wildcats

CALIFORNIA

Riverside County: Lyle Garner 1 G-G, NW NW 20-3s-7w, 25 BOPD, 25° gravity, perfs. 3,460-3,613 ft., TD 3,613 ft. (New field discovery near Padro Dam.)

Kern County: Standard Oil Co. of California 342 "20J," NW NE 20-21s-17e, 2,027 BOPD, 4 bbl. water, 34/64-in. choke, perfs. 11,356-11,620 ft., TD 11,620 ft. (New pool extension in Kettleman Hills field.)

Richfield Oil Corp. 163-28 ROC-KCL, SW NE 28-11n-20w, 117 BOPD, 49.5° gravity, 0.5 per cent cut, 11/64-in. choke, perfs. 7,823-59 ft. and 8,258-8,475 ft., TD 8,480 ft. (New pool discovery in Wheeler Ridge field.)

SOUTH LOUISIANA

Cameron Parish: California Co. 3-A OCS 0542, W½ Block 160, East Cameron area, Gulf of Mexico. IP 60 BOPD and 2,000 M.c.f. daily, 3/16-in., 60°, perforations 9,694-9,700 ft. (Miocene). TD 11,152 ft. (New pay in East Cameron Block 160 field.)

Evangeline Parish: Placid Oil Co. 2 Hillyer-Deutsch-Edwards, 22-5s-2w. IP 108 BOPD (net), 10 per cent b.s. and w., 7/64-in., 28.4°, perforations 7,247-51 ft. TD 10,020 ft. (New pay and extension in North Duralde area—first oil production.)

Lafourche Parish: Howell, Holloway & Howell and Petroleum, Ltd., 1 Levert, 40-14s-15e. IP 256 BOPD, ¼-in., 44.1°, GOR 12.1 M.c.f. per bbl., peforations 15,204-10 ft. TD 15,278 ft. (New field—3 miles northeast of Chacohouls field.)

Plaquemines Parish: Magnolia Petroleum Co. 2-A State Lease 2726, Block 46, Main Pass area, Breton Sound. IP 373 BOPD and 27,300 M.c.f. daily, calculated open-flow potential, 57.2°, perforations 9,004-20 ft. TD 12,060 ft. (New pay and second well in Main Pass Block 46 field.)

Terrebonne Parish: Humble Oil & Refining Co. 5-R L.L.&E., 8-19s-14e. IP 236 BOPD and 1,536 M.c.f. daily, ⅛-in., 36.6°, perforations 14,464-72 ft. TD 14,507 ft. (New pay and south extension, Bayou Penchant field.)

SOUTHEAST NEW MEXICO

Eddy County: Yates Bros. 1 Sherwich, 9 miles southwest of Artesia, 7 miles southwest of Dayton lower Grayburg and upper San Andres field in northwest part of county, 3-19s-25e. IPP 46 BOPD, 30°, perfs 1,214-30 ft. TD 2,617 ft. New oil discovery.

Lea County: Tennessee Gas Transmission Co. 1-B State Kemnitz, west offset to 1-A State Kemnitz, indicated discovery in west central part of county, 25-16s-33e. IPF 534 BOPD, ¼-in. choke, 42°, Permo-Penn. perfs 10,740-74 ft. TD 11,529 ft. New oil discovery.

NORTH DAKOTA

Ward County: W. A. Hanlon et al 1 A. O. Knudtson, NE SE 7-157n-87w. IPP 288 BOPD, Mission Canyon discovery, new field. TD 6,795 ft. Mission Canyon.

TEXAS GULF COAST

Goliad County: Head-Welsh 1 Key, Pedro Trevino Sur., A-45 (4 miles southwest of Charco). IP 2,700 M.c.f. daliy, open-flow potential, GLR 200 M.c.f. per bbl., 54.1°, shut-in pressure 1,525 psi., perforations 3,915-24 ft. (Pettus sand). TD 4,786 ft. (New field.)

Jackson County: Colorado Oil & Gas Corp. and Commonwealth Oil Co. 1 Bolling et al, Peter Aldrich Sur., A-2 (½ mile east of LaWard). IP 34.2 BOPD (net), 12.5 BW, P-37 choke, 56.2°, GOR 4,880 cu. ft. per bbl., perforations 8,632-34 ft. (Frio). TD 9,191 ft. (New field.)

Kenedy County: Delhi-Taylor Oil Corp. 2 McGill Ranch, Santa Rosa de Arriba Grant (Pedro de la Garza Sur., A-35). IP 11,000 M.c.f. daily and 32.6 BCPD, open flow, 65.3°, perforations 8,256-65 ft. (Frio). TD 8,515 ft. (New pay in McGill field.)

Nueces County: British-American Oil Producing Co. 5 Knolle, Subd. 1, Casa Blanca Grant, A-221. IP 161.56 BOPD, 5/32-in., 28°. GOR 620 cu. ft. per bbl., perforations 4,994-5,004 ft. (Vicksburg). TD 5,815 ft. (New pay in Knolle field.)

Refugio County: F. William Carr 2 Hynes, Power & Hewitson Sur., A-54 (12 miles northeast of Refugio). Shut-in gas-condensate well, no gage, perforations 5,919-21 ft. (Frio). TD 6,766 ft. (New field.)

San Patricio County: Conroe Drilling Co. and King & Heyne 1 Chandler, Section 79, Sixth Addition to Taft Farm Lands. Shut-in gas-condensate well, no gage, perforations 8,050-54 ft. TD 9,017 ft. (New pay in West Puerto Bay field.)

Victoria County: Coastal States Gas Producing Co. and Frio Drilling Co. 1 Gutman, Block 24, Kinnon Subd. Fleming Ranch, F. G. Hidalgo Sur., A-61. IP 2,420 M.c.f. daily, open flow, dry gas, perforations 4,129-32 ft. (Frio). TD 5,333 ft. (New field—1 mile south of Cologne field.)

SOUTHWEST TEXAS

Brooks County: The Texas Co. 18 McGill Brothers—NCT 11, San Antonio Grant,

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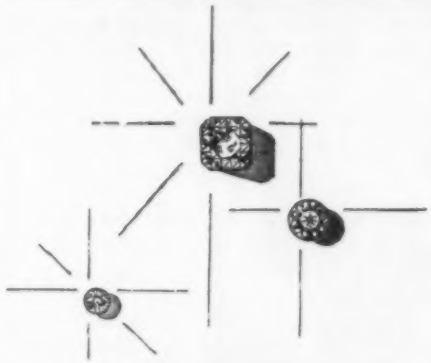

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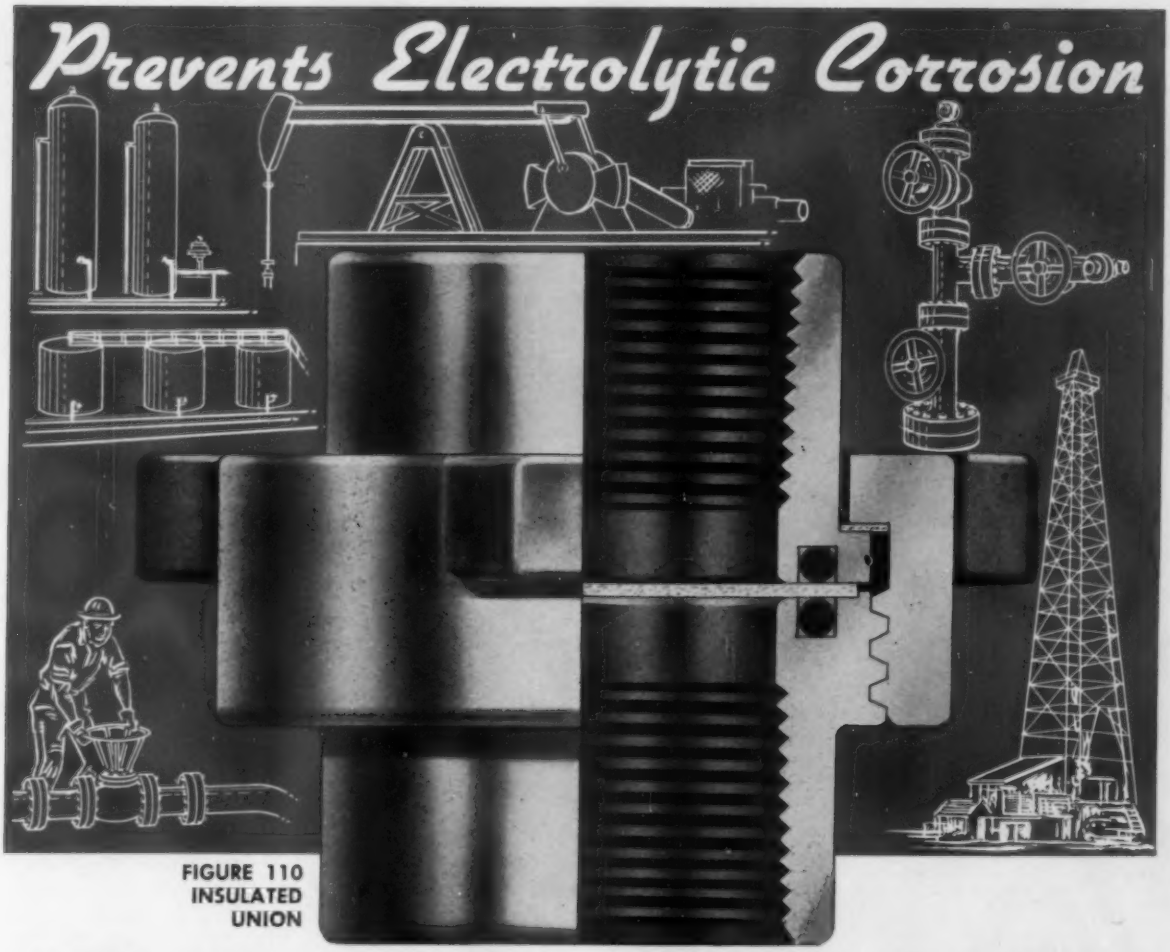

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2"	1,000 D.C.	30,000,000	30,000,000	None

BREAKDOWN TEST

Size	60 cycle Breakdown Voltage	Location of Breakdown	Damage to Insulating Material
¼"	1,500 RMS	Air gap between mating parts	None
2"	3,500 RMS	Air gap between mating parts	None

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Dimmit County: J. M. Loffland, Jr., and Colton & Colton 1 Kothman-Barnard, Section 686, I&GN Sur. (6½ miles northwest of Carrizo Springs). IP 25 BOPD (net), 20 per cent water, ½-in., 24.9°, GOR 456 cu. ft. per bbl., perforations 2,178-81 ft. (Navarro-Olmos 2-B sand). TD 2,600 ft. (New reservoir east of Rocky Creek field—new field.)

Duval County: Standard Oil Co. of Texas 14 Casey, Section 27, San Pedro de Charco Redondon Grant, A-475. IP 12 BOPD (net), 69 per cent water, ¼-in., 32°, GOR 23.6 M.c.f. per bbl., perforations 7,171-77 ft. (Yegua-Dolores 1) TD 7,540 ft. (New pay in Sejita field.)

Katz Oil Co. 5-H Peters, GB&CNG Sur., Section 33. IP 198.73 BOPD, 5/32-in., 38.2°, GOR 2,979 cu. ft. per bbl., perforations 5,685-98 ft. and 5,702-12 ft. (Queen City—second zone). TD 5,937 ft. (New pay in Peters field.)

Hidalgo County: Harrell Drilling Co. and H. G. Nelms 1 Armstrong, Lot 4, Block 25, Alamo Land & Sugar Co. Subd., Agostadero Grant. IP 1,100 M.c.f. daily, open flow, 19 BC per M.M.c.f., 70.5°, perforations 5,479-5,501 ft. (Frio) and (dual completions) 1,040 M.c.f. daily, open flow, dry gas, perforations 5,412-28 ft. (Frio). TD 6,700 ft. (New reservoir and extension, Donna area.)

LaSalle County: Los Gatos Oil Co. 2-A Harris, Section 40, I&GN Sur., A-424. IP 8,000 M.c.f. daily, open flow, dry gas, perforations 4,210 ft. (ring) in Wilcox. TD 5,052 ft. (New pay in Los Angeles field.)

Starr County: Sun Oil Co. 10 Reilly Heirs. Share 2, Porcion 97. IP 14.13 BOPD (net), 37 per cent water, 44.2°, perforations 5,761-71 ft. (Vicksburg-Rincon 2). TD 6,000 ft. (New pay in Braulia field.)

J. M. Taylor and M. E. Andrews 2 Maresh, Survey 503 (20 miles northeast of Rio Grande City). IP 65.82 BOPD (net), 60 per cent water, 5/32-in., 40.1°, GOR 1,990 M.c.f. per bbl., perforations 3,903-06 ft. (Frio). TD 3,911 ft. (New pay in West Rincon field.)

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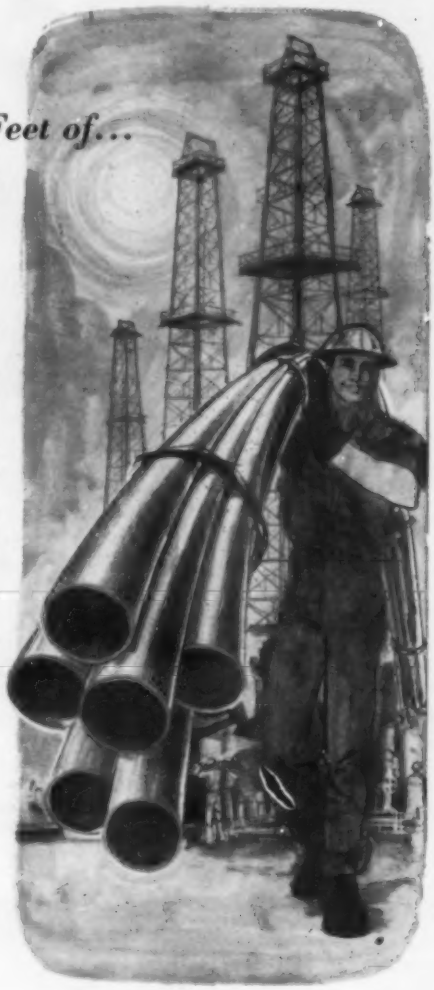

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NORTH TEXAS

Archer County: Bobby M. Burns 1 Cowan & McKinley "F," 3½ miles southeast of Anarene in G. C. Frarley Sur. A-129. IPF 145 BOPD, Miss. 5,154-60 ft., 44°. TD 5,178 ft. New oil discovery 1 mile north of 4,800-ft. production in southeastern part of county.

Cheyenne Oil Corp. 1 Fannie B. Forcher, 5 miles southeast of Wichita Falls in northeastern part of county in South Vogtsberger field, Sec. 13, Blk. 1, H&TC Sur. IPF 119 BOPD, 10/64-in. choke, 44°, conglomerate pay 5,388-5,400 ft. New oil discovery in South Vogtsberger field.

Cooke County: Felderhoff Bros. Drilling Co. 2 Evans, 2,000 ft. west of 3,000-ft. production in J. M. Stevens Sur. A-1441. Univ. Lge. 7, Blk. 6. IPP 51 BOPD, 2-in. tubing 3,224-33 ft. TD 3,684 ft. New oil discovery.

Jack County: Grace-Ford Oil & Gas Co., Inc., 6 L. A. Worthington "B," W. Ross Sur. A-498. IPP 55 BOPD, 36°, Capps lime open hole 1,944 ft. TD 1,957 ft. New oil discovery in Ken Rich Bryson sand field.

Knox County: Corvette Oil Co. 1 J. J. Foshee, 3 miles northeast of Knox City, 1 mile south of Tannehill production in D. G. Burnett Subd. 1. IPP 127 BOPD, 36°, 2,085-95 ft. TD 2,412 ft. New oil discovery.

Lomax & Maxwell 1 J. C. Kuhler, 5 miles northwest of Goree in southeast part of county, Subd. 2, D. G. Burnett Sur. No. 21 A-10. 1 mile east of production. IPF 76 BOPD, 35°, Tannehill sand 1,875-85 ft. TD 1,956 ft. New oil discovery.

WEST CENTRAL TEXAS

Palo Pinto County: West Texas Exploration Co. 1 W. H. Belding, 5 miles north of Baird in northwest part of county in Sec. 103, BBB&C Sur. A-96. IPP 10 BO and 5 BWPD, 38.4°, pay 1,911-18 ft. TD 4,039 ft. Marble Falls. New oil discovery.

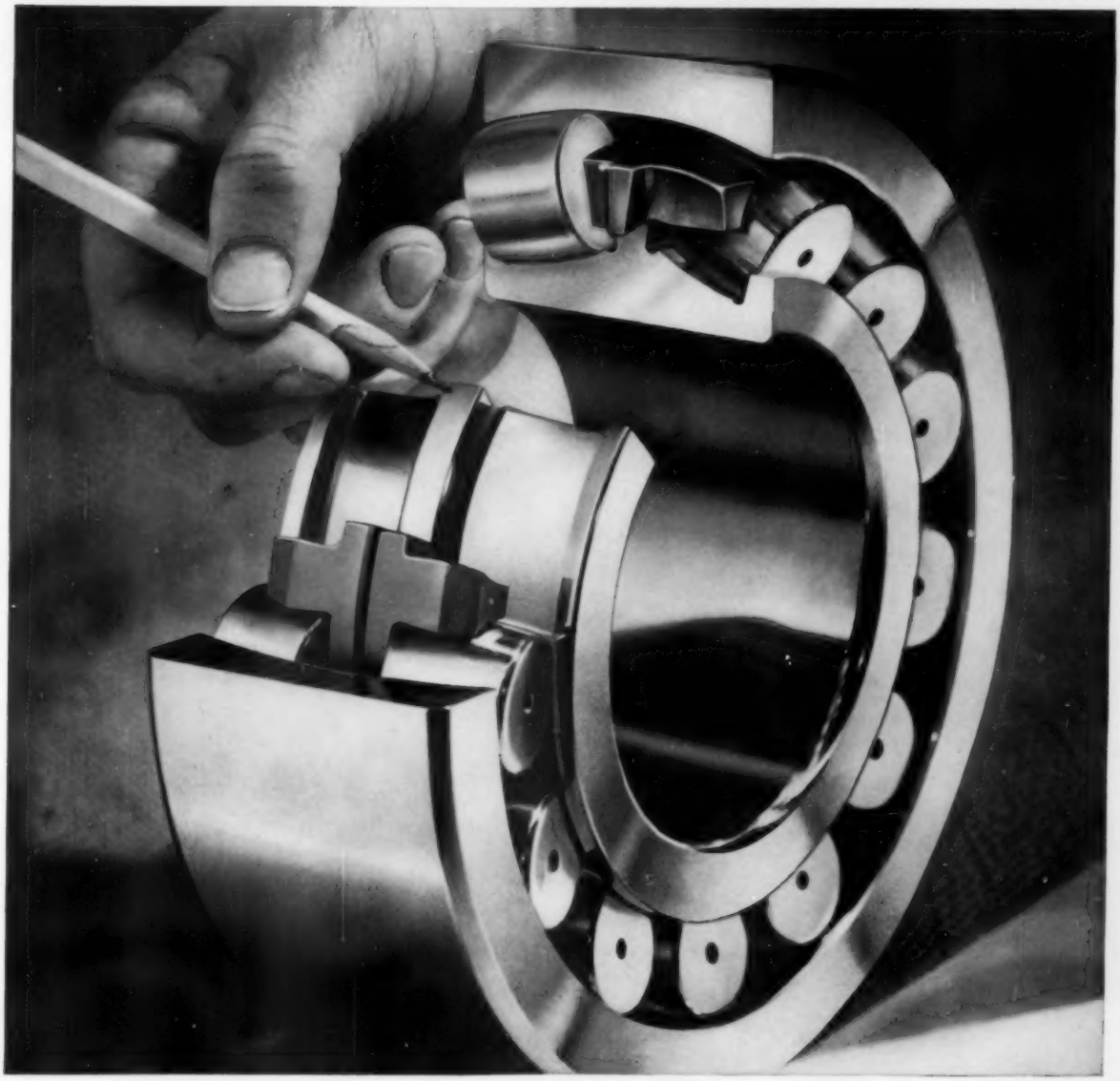
Stephens County: J. E. Connally et al 1 Minnie Adams, 15 miles southwest of Breckenridge in southwest part of county, John Stephenson Sur. No. 29 A-159. IP 2,446 M.c.f. of gas per day on absolute open flow. Open hole in Marble Falls lime, top pay 3,685 ft. TD 3,898 ft. New gas discovery.

Throckmorton County: Cheyenne Oil Corp. 1 W. L. Richards et al, 5 miles southwest of Throckmorton in south-central part of county in Blk. 8, Andrew J. Morgan Sur. A-226. IPF 120 BOPD, 10/64-in. choke on 2-in. tubing at 4,495 ft., 41°, upper Caddo, perfs. 4,298-4,304 ft., 58 BOPD, 18/64-in. choke, 41°, lower Caddo perfs. 4,505-17½ ft. TD 4,783 ft. Dual completion. New oil discovery.

UTAH

San Juan County: Pan American Petroleum Corp. 1 Martha Featherstone, NW SW SW 24-40s-22e. IPF 192 BOPD, 20/64-in. choke, Ismay pay, new field discovery. TD 5,795 ft. Salt.

TORRINGTON *SPHERICAL ROLLER* BEARINGS



"This flange guides the rollers to peak performance!"

The center flange on the inner raceway of the TORRINGTON Spherical Roller Bearing positions the rollers to handle thrust loads. This accurate positioning also assures radial stability of the rollers under heavy loads—even at continuous high speeds and under conditions of misalignment.

This superior design feature is only one of many advantages you get when you specify TORRINGTON. For example, you get the service of TORRINGTON'S experienced engineers, who will help you with design and maintenance problems—or design custom bearings for special applications.

For long, low-maintenance service in heavy-duty applications, order TORRINGTON Spherical Roller Bearings. They're available from stock with either straight or tapered bore, for shaft or adapter mounting.

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This man knows why

MISSION LINERS

cut both piston and liner costs

THIS MAN IS CHECKING both the hardness and thickness of the hardened area of the bore of a test sample from a Mission Super-Service® Slush Pump Liner. His findings are reproduced in graph form *below*.

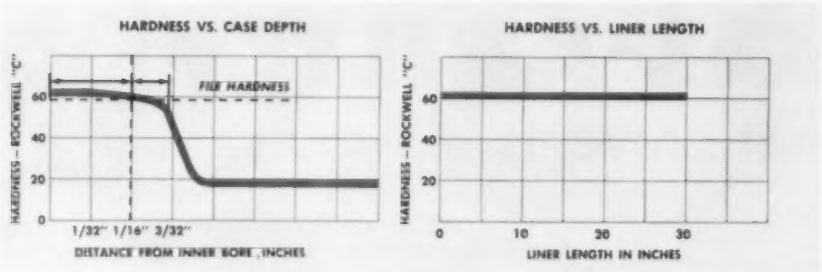
This means that Mission Liners wear slowly *throughout their entire life*. They wear far longer than some liners which start out wearing slowly, but "give up" fast after the thin case is worn off and softer metal is reached.

The graph *at the right* shows that hardness and depth of hardness are perfectly uniform throughout the length of the liner. There are no soft spots to wear unevenly.

It's not easy to get uniformity like this. It takes the finest and most modern induction hardening equipment, plus a lot of care and metallurgical skill—elements not available to some manufacturers.

Although liners may look a lot alike, there are big differences that don't meet the eye. Some are flame hardened, some are carburized and some utilize other special techniques. Mission has tested many liners made by various methods but found nothing to produce results like those obtained from induction-hardened Mission Super-Service Liners.

Play it safe! For the best in slush pump performance specify MISSION when you order liners from your supply stores. You will save money and trouble when you do.



This graph shows that Mission Liners have a true "File Hard" bore throughout the useful wearing depth of 1/16". This means long liner life.

This graph illustrates that hardness is absolutely uniform throughout the wearing area of the liner. This means uniform slow wear.

Nothing but the finest will bear the name of MISSION MANUFACTURING CO

MISSION MANUFACTURING CO. • P. O. Box 4209 • Houston, Texas • Cable Address—"Missco" • Export Office: 30 Rockefeller Plaza, New York
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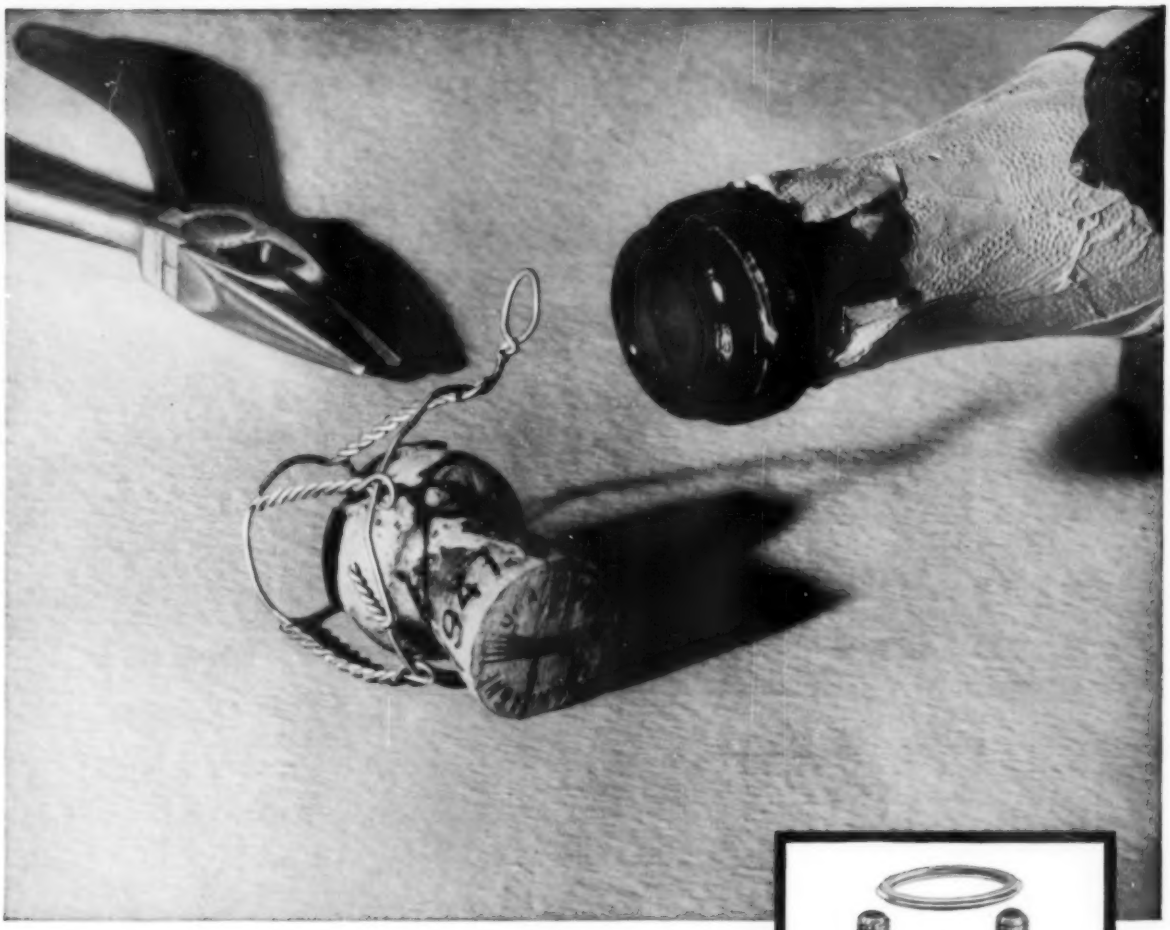
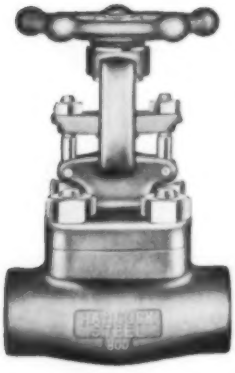


SEAL-ABILITY
that prevents blowouts



THE FLEXITALLIC GASKET creates a positive, pressure-tight seal in the bonnet joint of the Type 950 Hancock Steel Gate Valve. It is a spiral-wound ribbon of stainless steel with asbestos filler and spring-like compressibility. The gasket can be reused – cannot be flattened as the flanges which retain it form an integral compression gauge. Because the gasket rests in a groove in the body flange, it cannot blow out *even if pressures exceed ten times the rating of the valve.*

Only a specially-designed bonnet joint can fully utilize the tremendous sealing power of the Flexitallic gasket. And, advanced engineering proves that an investment in Hancock quality pays dividends in trouble-free performance. Let your nearby Industrial Supply Distributor explain fully. Phone him today.

HANCOCK VALVES

A product of

MANNING, MAXWELL & MOORE, INC.

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Transco's big plans mean . . .

Busy Days Ahead for McGraw

E CLYDE McGRAW has taken over the reins of Transcontinental Gas Pipe Line Corp. in the midst of the greatest expansion program in the company's history.

Former executive vice president of the company, McGraw was elected president and chief executive officer in a surprise move by Transco directors. He succeeds Tom P. Walker, who was named to the newly created position of chairman of the board.

Walker, who was president of the company during the past 4 years, was principal architect of the recently stepped-up expansion program. He vacated the presidency at a time when company earnings and gas deliveries were breaking all records.

"As you know," he told stockholders in a glowing report, "our pipeline is at the threshold of the largest natural-gas market in the world. Seventeen million people live in the eastern area which we serve, representing 5½ million families. Only now the full potential of the market is being realized by the distributor companies which serve it."

No let up . . . The company's growth can be expected to continue at a fast pace under the new president.

Plans already approved for 1957 would increase capacity of the company's transmission line about 25 per cent, from 754 million cubic feet to 945 million cubic feet of gas daily. Gas deliveries from storage would boost the system's peak-day capacity to well over 1 billion cubic feet.

Cost of the expansion program now under way is estimated at about $113,000,000.

McGraw's wide experience in pipelining and long association with Transco make him a natural to guide the company on the aggressive course laid out by Walker.

McGraw has been associated with the company almost since its inception. Before officially joining the Transco family in 1950, he was vice president of Stone & Webster Service Corp. His basic job was as advisor to natural-gas companies. He helped plan and engineer Transco's 1,840-mile natural-gas line from Texas to New York.

McGraw's record . . . The new president joined Transco as vice president of operations about the time the company started delivering gas through the new pipeline.

During the next 5½ years he saw the company, as a major supplier of gas to the New York-New Jersey-Philadelphia metropolitan area, increase its deliveries from practically nothing to about 700,000 M.c.f. per day.

E. CLYDE McGRAW
. . . The firm orders are already in.

In 1955 McGraw was promoted to executive vice president. He was elected to the board of directors last May.

Born December 15, 1903, at Elwood, Neb., McGraw was graduated from the University of Nebraska in 1927 with a B.S. degree in electrical engineering. He and Mrs. McGraw live in the River Oaks section of Houston. They have three sons.

Like his predecessor, McGraw is expected to strive for economy in operations while increasing the firm's gas reserves and pipeline capacity to meet the needs of expanding markets.

The company will continue to use 30 and 36-in. pipe for looping of its main system and to expand its underground-storage facilities near its big New York market. These policies, the company claims, have contributed to cheaper service and a competitive advantage in its major marketing areas.

But, as far as growth is concerned, Transco expects a busy future. The company already has firm orders for pipe to meet its estimated requirements through 1960.

Dwight B. Sprow, assistant vice president of Natural Gas Pipeline Co. of America and Texas Illinois Natural Gas Pipeline Co., has been named vice president in charge of operations. Sprow succeeds **Mark V. Burlingame,** recently appointed executive vice president of the two companies.

Personals

C. Taylor Cole, geological consultant, has moved his offices to Corpus Christi, Tex., from Chicago.

F. M. (Cappy) Ricks has opened consulting offices in Denver. Ricks was formerly exploration manager for Midwest Oil Corp. in Denver.

Kenneth E. Carter has resigned as Atlantic Refining Co.'s district geologist in Durango, Colo., to open consulting offices there.

Dr. Wilson B. Emery, retired Ohio Oil Co. vice president, has joined American National Bank, Denver, as vice president of the petroleum division. Emery retired from Ohio Oil in 1955.

Elbert F. Davis, Continental Oil Co.'s production engineer in Ville Platte, La., has been promoted to district engineer and transferred to Yorktown, Tex.

J. M. Ewers, vice president of Alex W. McCoy Associates, Inc., and manager of the company's Casper, Wyo., office, has been transferred to Tulsa to handle special assignments. Ewers joined the company in 1953. **Dr. John Bokman,** research geologist with Carter Oil Co., has joined McCoy Associates in Tulsa as geologist.

Roy E. Nelson has been elected vice president of American Gilsonite Co. in addition to his position as manager of production. A graduate of Massachusetts Institute of Technology, Nelson was with Standard Oil Co. of California before transferring to American Gilsonite, an affiliate, in 1949.

Lewis O. Vogelsang, vice president and general manager of Rio Grande Valley Gas Co. since 1946, has succeeded **Odbert P. Wilson** as president of the company. Wilson has been named chairman of the board and chief executive officer. In other Rio Grande changes, **Arlen G. Swiger,** first vice president and a director, has been appointed vice chairman of the board and chairman of the executive committee. **Clayton A. Irwin,** general superintendent of operations and assistant vice president, has moved up to vice president, and **Warner H. Meredith** has been named vice president and treasurer.

Personals

ROLLIN ECKIS

Rollin Eckis, David E. Day, William J. Travers, and **William G. King, Jr.,** vice presidents of Richfield Oil Corp., have been elected to the company's board of directors. Eckis has been with Richfield since 1937. He was vice president and exploration manager before being named executive vice president last year. Day has been vice president and manager of manufacturing, pipeline, marine transportation, and research since 1945. He also is a director of Trans Mountain Oil Pipe Line Co. and Four Corners Pipe Line Co. Travers, head of the company's production department, has been a vice president since 1953. King has been general sales manager and vice president since 1949.

W. J. TRAVERS

D. E. DAY

L. G. Harper, formerly area petroleum engineer in Pierce, Tex., for The Texas Co., has joined Blanco Oil Co., San Antonio, Tex., as assistant to the company's general superintendent, **R. O. Van Fleet.**

Dr. Donald E. Burney and **G. Hans Weisemann,** group leaders in the Whiting, Ind., research department of Standard Oil Co. (Ind.), have been promoted to section leaders in the chemical products division there.

J. Bruce Craig, Sinclair Oil Co. district representative at Corpus Christi, Tex., has been appointed administrative assistant in Tulsa. Three new district representatives have been named by the company. They are **J. D. Byfield,** chief of the connection-order section in Tulsa, now Houston district representative; **Harold H. Dillon,** Oklahoma City, transferred to Tyler, Tex., as district representative; and **Donald C. Frazier,** formerly in Wichita Falls, Tex., now Corpus Christi district representative.

Joe Carroll has been transferred by The Texas Co. to Wichita Falls, Tex., from Pampa, Tex. He is a petroleum engineer.

Glenn W. King, field engineer with Pan American Petroleum Corp., has been transferred to Odessa, Tex., from Sweetwater, Tex.

Gordon B. Leith, gas-management engineer with Tennessee Gas Transmission Co., has been transferred to Victoria, Tex., from Falfurrias, Tex.

A. Rowland Boucher, staff geologist with Alex W. McCoy Associates, Inc., has been appointed a vice president. Boucher joined McCoy in 1953. He previously was with Phillips Petroleum Co. and Gulf Oil Corp.

James A. Rehler, vice president and manager of Blanco Oil Co., has resigned to become an independent in San Antonio, Tex. Rehler was with Amerada Petroleum Corp. and Shell Oil Co. before joining Blanco in 1952.

W. M. Elmer, senior vice president of Texas Gas Transmission Corp. since 1955, has been elected executive vice president of the company. He will continue as president of Texas Gas Exploration Corp. Elmer is a director of both companies.

J. P. Berkin has been named to succeed **J. W. Platt** as managing director of Shell Petroleum Co., Ltd., and a principal director of N.V. de Bataafsche Petroleum Mij., two parent operating companies of the Royal Dutch-Shell Group. Platt will retire at the end of June but will remain a director of Shell Petroleum and Shell Transport & Trading Co., Ltd. Berkin has been a director of Shell Petroleum since 1953, and was recently named to the board of Shell Transport & Trading.

John G. Seiler, National Cylinder Gas Co., has been elected chairman of the eastern district of Petroleum Equipment Suppliers Association. He succeeds **Paul Scherf,** Alten Foundry & Machine Works, Inc. **S. P. Wallace,** Maloney-Crawford Tank & Manufacturing Co., has been named chairman of the Mid-Continent and Rocky Mountain district succeeding **John G. Staudt** of Dowell Incorporated. Director of P.E.S.A.'s southwestern district is **Ott Hammer,** Dresser Operations. Hammer replaces **M. E. Montrose,** Hughes Tool Co., who has been named a director-at-large in the southwestern district. **H. J. Hagn** of Chiksan Co., has succeeded **W. T. Powell** of Continental-Emsco Co. as Pacific district chairman.

Donald W. Jackson, Panhandle Eastern Pipeline Co. zone engineer in Borger, Tex., has been appointed manager of engineering in the production department, Liberal, Kans.

A. H. Ingley, Diamond Alkali Co.'s vice president in charge of manufacturing, has been named a director. Ingley has been with the company since 1920.

Donald L. Anderson has been appointed supervisor of gas purchases for Pacific Northwest Pipeline Corp. Anderson has been with Pacific Northwest since 1952. Earlier he was with Houston Natural Gas Co.

Wayne W. Melton has been promoted to main-line chief engineer of Magnolia Pipe Line Co.'s Foreman, Ark., pump station. **T. S. Greenlee** has been transferred to the company's Waelder, Tex., pump station as main-line chief engineer.

John K. Voorhees, general superintendent of the Standard Oil Co. (Ohio) Latonia refinery, Covington, Ky., has been promoted to general process superintendent of the company's Lima, Ohio, refinery. Voorhees replaces **John D. Stubbs,** who has resigned. **Donald W. Heil,** chief process engineer at the company's No. 1 refinery, Cleveland, will replace Voorhees as general superintendent at Covington.

Leo LeBron, marine superintendent for Kerr-McGee Oil Industries, Inc., has been named to head the company's Venezuelan operations. LeBron joined Kermac in 1948 as construction engineer in the Gulf Coast. He was later transferred to the Neutral Zone. LeBron was project manager for Kermac's Alaskan drilling operations before being named marine superintendent in 1954. He is a graduate of the University of Oklahoma. Kermac is scheduled to begin activity in Venezuela this summer. Company headquarters will be in Maracaibo (see international news).

Paul Benedum, Hiawatha Oil Co., Pittsburgh; **R. G. Strong,** Natural Gas Pipeline Co. of America, Chicago; **John Buckwalter,** Ryder Scott Co., Wichita Falls, Tex.; and **W. B. Simpson,** Hope Natural Gas Co., Clarksburg, W. Va., will receive citations for service at the American Petroleum Institute's Division of Production, eastern district meeting this week in Pittsburgh.

W. F. Bramstedt, president of California Texas Oil Co., Ltd., has been named to succeed **W. H. Pinckard,** chairman of the board and chief executive officer, who has retired. **A. J. Singleton,** executive vice president, will succeed Bramstedt as president. Pinckard joined The Texas Co. in 1917. He helped form the Caltex group in 1936 and had been Caltex president since 1946. He was named board chairman in 1950. Bramstedt, born in the Philippines, joined Standard Oil Co. of California in 1927. He was elected executive vice president of Caltex in 1949 and president in 1950. Singleton, who was born and educated in Ireland, was managing director of Galena Signal Oil Co. (of Ireland), Ltd., when it was acquired by The Texas Co. in 1929. He was later managing director of Texaco's English subsidiary and has been executive vice president of Caltex since 1951.

SINGLETON

BRAMSTEDT

E. P. Fay has been appointed assistant manager of Standard Oil Co. of California's Eastern Hemisphere staff. Fay has been with Socal since 1947 and has been senior and supervising analyst on the Eastern Hemisphere staff since 1954.

E. B. Maki and **Gordon Van Fossen,** exploitation engineers for Shell Oil Co., have been transferred to Billings, Mont., from Glendive, Mont. **W. J. Rodgers** has been transferred to Billings from Glendive as division mud engineer. **J. A. Duren,** division exploitation engineer in Glendive, has been transferred to Tulsa. **J. A. Pederson** will succeed Duren as division exploitation engineer but will have headquarters in Billings.

Chris J. Poppelreiter, superintendent of Chicago District Pipeline Co., a subsidiary of Peoples Gas Light & Coke Co., has been named construction engineer in the engineering department of Peoples Gas. **Raymond P. Lynch,** assistant superintendent of Chicago District Pipeline, succeeds Poppelreiter. **Clifford D. Older,** supervisory engineer with Peoples Gas, has moved up to assistant superintendent of the pipeline firm, replacing Lynch.

Walter Seifert, process engineer with Continental Oil Co., has been transferred to Gretna, La., from Ponca City, Okla.

J. C. Curry, Continental Oil Co.'s production engineer in Oklahoma City, has been promoted to district engineer and transferred to Great Bend, Kans.

Kingsley V. Schroeder, director of production for Sun Oil Co., has been elected to the board of directors. He succeeds **R. W. Pack,** former director of production, who retired last year.

William D. Leake has been promoted by Richfield Oil Corp. from production engineer in New Cuyama, Calif., to development engineer in Santa Barbara.

James Hamilton has joined Pacific Petroleums, Ltd., in Calgary as staff geologist. Hamilton was formerly geologist with El Dorado Refining Co. in Denver.

Kurt Alfred Dettmers, petroleum engineer with Carter Oil Co. in Magnolia, Ark., has joined Mene Grande Oil Co. in Santome, Venezuela, as petroleum engineer.

Thomas S. Mainard, production superintendent for E. K. Cary Drilling Co. in McPherson, Kans., has joined American Independent Oil Co. in Kuwait as production superintendent.

David Johnston has been promoted by Humble Oil & Refining Co. from assistant district superintendent in Genoa, Tex., to district superintendent in Monroe City, Tex.

Neil McDaniel, Champlin Oil & Refining Co.'s assistant district engineer in Oklahoma City, has been promoted to district engineer in Sinton, Tex.

J. R. Parker has been named district superintendent in Eunice, N. M., for Continental Oil Co. Parker moves up from senior drilling foreman at Eunice. **C. E. Wilson,** senior production foreman in Ardmore, Okla., has been appointed district superintendent there.

P. L. Gant, research chemist with Continental Oil Co., Ponca City, Okla., has been named senior research chemist. **W. H. Snavely,** analytical chemist at the company's Ponca City refinery, has been appointed associate research chemist, central research department, and **J. D. Alexander,** assistant research engineer, has been named associate research engineer in production at Ponca City.

Personals

Garry Owen, Arabian American Oil Co.'s representative in Jidda, Saudi Arabia, since 1948, has been named vice president. He will act as Aramco's representative on company matters with the Saudi Arabian Government. His headquarters will be in Dhahran.

N. Wood Bass has resigned from the United States Geological Survey in Denver to open consulting offices there.

Sumner E. Campbell has joined Macmillan Petroleum Corp. as director of research in Long Beach.

George E. Dozier, formerly geologist with Gulf Refining Co., has joined Atlantic Refining Co. in Dallas.

W. J. Weaver, Fort Worth independent, has been elected a director of Trinity Oil Corp., Fort Worth.

Paul Schmidt, associate engineer for Continental Oil Co., has been promoted to production engineer and transferred to Corpus Christi, Tex., from Rincon, Tex.

O. P. Thomas, vice president of Sinclair Oil Corp., and **R. W. Hines,** manager of production for Texas Pacific Coal & Oil Co., have been named directors of Texas Pacific Coal & Oil.

DEATHS

John L. Gallagher, 61, Tulsa, general superintendent of Sinclair Oil & Gas Co.'s gas and gas-products department, died April 18 in Tulsa.

Ernest Robinson, 61, drilling superintendent in Santa Barbara, Calif., for Tidewater Oil Co., died April 14 in Santa Barbara.

Frank L. Ring, 67, vice president of Ring Oil Co., died April 15 in Los Angeles.

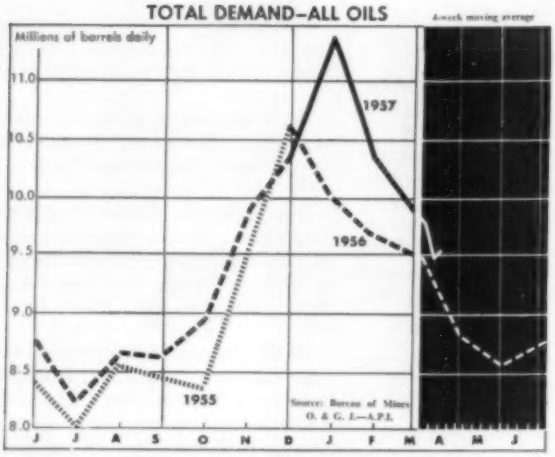
Alexander N. Warner, 70, Titusville, Pa., independent, and founder of Warner-Caldwell Oil Co., died April 19 in Titusville.

George F. Dodge, Jr., division landman in Denver for The California Co., died April 14.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,577,075	UP	102,850	UP	429,986
Crude stocks	255,316,000	UP	2,991,000	DOWN	11,769,000
Completions	1,003	UP	84	DOWN	138
Refinery runs	7,690,000	DOWN	209,000	UP	254,000
Gasoline stocks	201,945,000	DOWN	959,000	UP	9,012,000
Kerosine stocks	19,779,000	DOWN	44,000	UP	1,912,000
Distillate stocks	72,801,000	DOWN	1,355,000	UP	10,875,000
Residual stocks	36,943,000	UP	185,000	UP	4,114,000
Four-product stocks	331,468,000	DOWN	2,173,000	UP	25,913,000



Measure Your Gasoline-Stock Excesses Against Records for Several Years

HOW DOES your gasoline-stock position compare with that of the industry as a whole? When the gasoline-stock total is too high and prices are sagging, it is hard to find a supplier who will admit that he has too much gasoline or that he is moving some spot material under the normal market.

The tables at the bottom of the page show total gasoline stocks at the end of April for past years and also stock changes during the month. Note that the trends vary by districts. On the East Coast, the end-of-April stock level has climbed gradually since 1953, but with a little extra added in 1956.

District 2 had less gasoline at the end of April 1955 than on the corresponding date of 1954, but reported a sharp gain for 1956. The trend for District 3 has been very similar to that reported for District 1. District 5 had practically no gain in 1955.

These end-of-April stocks for 1956 can be compared with current inventories shown in the A.P.I. refinery report on page 277. The first two refining districts make up PAD District 1. The next four listed areas make up District 2. District 3 includes the next five areas. District 4 is the same as refining district "Other Rocky Mountains," and District 5 is listed as California.

These weekly reports have shown that the gain in gasoline stocks over the corresponding weeks last year dropped in March. On March 8, stocks were 10.1 million barrels above the same week of 1956 but the difference was down to 5.3 million by March 29. However, the trend started back up the following week. Stocks on April 5 topped the previous year by 6.0 million and the surplus climbed to 7.8 million barrels on April 12.

The current report for April 19 shows gasoline stocks up 9.0 million barrels over the same week of 1956.

Changes in gasoline stocks during April are shown for recent years in the last two tables. How do your gains compare with industry totals?

GASOLINE STOCKS AT END OF APRIL
(Thousands of barrels)

PAD districts—	1956	1955	1954	1953
District 1	45,871	42,339	40,897	39,084
District 2	65,103	57,405	62,102	53,665
District 3	49,239	45,947	43,804	39,114
District 4	7,698	7,869	8,177	6,890
District 5	25,388	22,041	22,026	19,279
Total U. S.	193,299	175,601	177,006	158,032

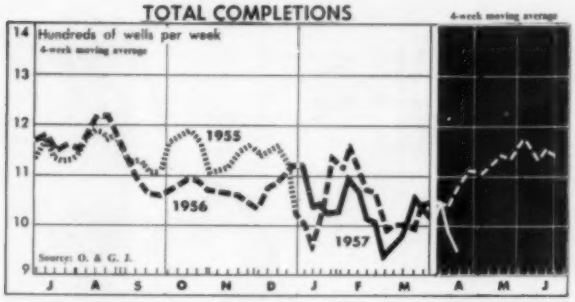
CHANGE ON GASOLINE STOCKS DURING APRIL
(Thousands of barrels)

	1956	1955	1954	1953
District 1	217	354	—740	96
District 2	—3,474	—5,875	—2,411	—3,128
District 3	—2,067	—2,831	—241	—2,262
District 4	—607	—757	—153	—257
District 5	—468	738	—746	852
Total U. S.	—6,399	—8,371	—4,291	—4,699

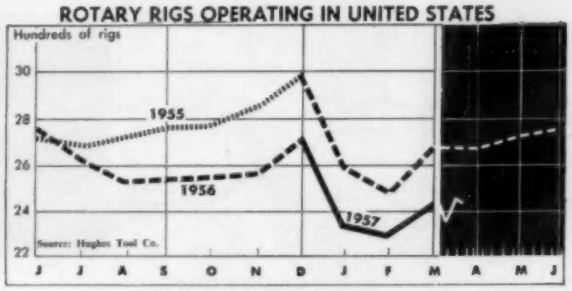
PER CENT CHANGE IN GASOLINE STOCKS DURING APRIL
(Per cent)

	1956	1955	1954	1953
District 1	0.5	0.8	—1.8	0.2
District 2	—5.1	—9.3	—3.7	—5.5
District 3	—4.0	—5.8	—0.5	—5.5
District 4	—7.3	—8.8	—1.8	—3.6
District 5	—1.8	3.5	—3.3	4.6
Total U. S.	—3.2	—4.6	—2.4	—2.9

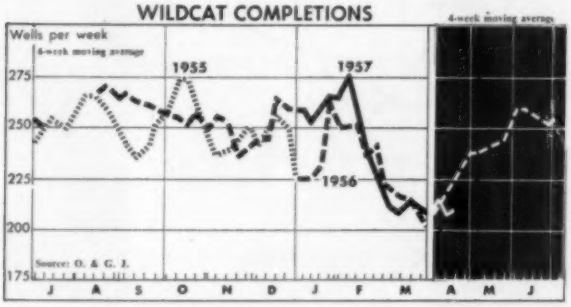
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	4-22-57	4-15-57	4-23-56
North Central and East	83	70	112
Southeast	41	47	28
Okla., Kans., Ark., Mo.	431	421	498
Louisiana	418	420	441
North and East Texas-Panhandle	405	429	438
Gulf and South Texas	230	230	262
West Texas-New Mexico	537	560	554
Rocky Mountain	200	195	227
Pacific Coast	87	91	135
Total United States	2,432	2,463	2,695
Western Canada	99	108	95

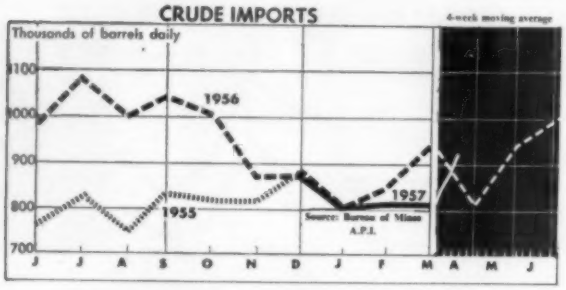
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED APRIL 20, 1957

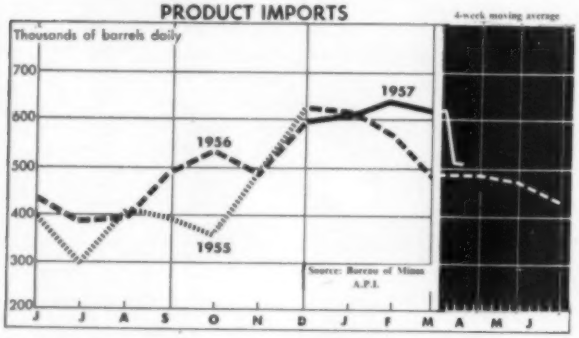
	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1957				
	Comp.	Oil	Gas	Dry	Footage	1957	1956	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	¶1	1	0	0	11,500	34	32	0	0	0	0	0	0	0	1	13	14
Arkansas	11	10	0	1	27,971	297	229	0	0	0	0	0	5	0	1	38	44
California	44	34	1	9	176,071	596	644	2	0	0	8	10	14	0	2	137	153
Colorado	13	2	1	10	70,511	289	343	0	0	1	9	10	11	0	4	182	197
Illinois	73	25	0	48	176,835	727	997	0	0	0	19	19	7	0	1	170	178
Indiana	6	2	0	4	9,236	188	184	0	0	0	1	1	3	0	0	38	41
Kansas	65	28	5	32	237,605	1,303	1,510	3	0	0	13	16	38	0	8	197	243
Kentucky	28	8	4	16	40,466	440	494	1	0	1	5	7	11	0	3	81	95
Louisiana	83	51	5	27	740,999	1,139	1,180	1	0	1	13	15	27	9	28	134	198
North	15	11	1	3	45,351	400	442	0	0	0	1	1	3	0	2	39	44
South	48	26	3	19	517,312	523	589	1	0	1	11	13	17	8	20	81	126
Offshore	20	14	1	5	178,336	216	149	0	0	0	1	1	7	1	6	14	28
Michigan	6	3	0	3	18,839	117	146	0	0	0	2	2	4	0	0	49	53
Mississippi	6	1	0	5	37,400	108	128	0	0	0	3	3	7	0	0	42	49
Montana	8	5	0	3	52,070	94	101	0	0	0	2	2	2	0	0	30	32
Nebraska	14	2	0	12	77,042	241	283	1	0	0	6	7	14	0	0	116	130
New Mexico	33	21	5	7	150,897	604	544	0	0	0	4	4	24	1	5	66	96
Northwest	6	1	5	0	24,679	224	196	0	0	0	0	0	12	1	4	22	39
Southeast	27	20	0	7	126,218	380	348	0	0	0	4	4	12	0	1	44	57
New York	9	4	0	†5	9,250	140	....	0	0	0	0	0	0	0	0	0	0
North Dakota	2	2	0	0	17,455	90	68	0	0	0	0	0	4	0	0	30	34
Ohio	16	9	2	‡5	42,428	317	317	0	0	0	0	0	0	0	0	3	3
Oklahoma	122	78	2	§42	440,554	2,049	2,672	3	0	1	11	15	33	7	6	188	234
Pennsylvania	13	0	10	3	90,586	321	*242	0	0	0	0	0	0	0	11	18	29
Texas	419	262	16	141	1,652,550	6,564	6,627	12	4	2	69	87	200	16	69	1,460	1,745
Southwest (1 & 4)	73	41	5	27	270,643	793	976	2	2	0	13	17	29	4	20	240	293
Gulf Coast (2 & 3)	57	34	6	17	362,815	772	837	2	2	2	10	16	16	8	36	207	267
East (5 & 6)	21	6	2	13	111,499	377	337	0	0	0	10	10	4	0	2	114	120
N. Central (7-B & 9)	151	93	0	58	412,596	2,361	2,339	6	0	0	20	26	103	0	5	629	737
West (7-C & 8)	98	73	0	25	431,974	1,855	1,778	2	0	0	15	17	45	0	5	246	296
Panhandle (10)	19	15	3	1	63,023	406	360	0	0	0	1	1	3	4	1	24	32
Utah	4	2	0	2	24,441	49	25	1	0	0	2	3	4	0	2	25	31
West Virginia	10	0	6	4	27,769	196	210	0	0	0	0	0	0	0	7	2	9
Wyoming	12	5	0	7	39,326	236	221	0	0	0	5	5	10	0	2	74	86
Miscellaneous (S. D.)	5	0	0	5	15,233	24	50	0	0	0	5	5	0	0	1	18	19
Total United States	**1,003**	555	57	391	4,187,034	16,163	17,247	24	4	6	177	**211**	418	33	151	3,111	3,713
Total previous week	919	495	65	359	3,746,404	.....	.....	25	2	7	151	185	394	29	145	2,934	3,502
Total April 21, 1956	1,141	625	80	436	4,682,845	.....	.....	27	4	7	209	247	477	54	109	3,146	3,786
Cumulative 1957	16,163	8,595	1,198	6,370	66,927,820	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Western Canada	16	6	1	9	86,350	805	772	0	0	1	7	8	19	0	17	188	224

*Incl. N. Y., ¶Ala. Service wells included: †5, ‡2, §7.

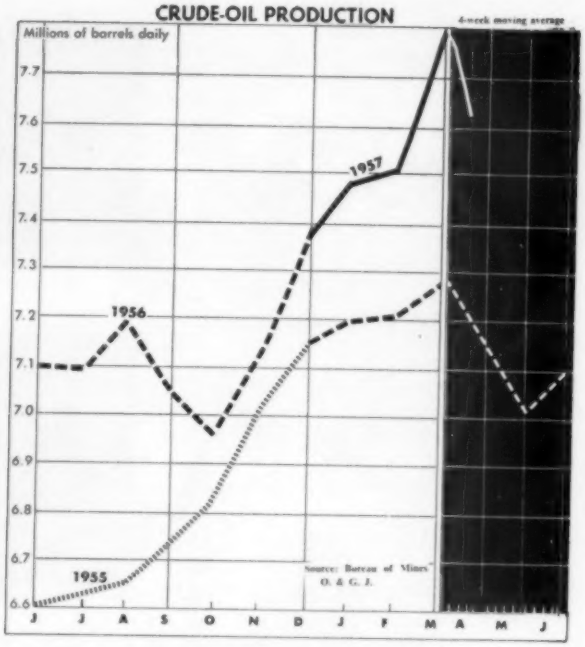
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION



DAILY AVERAGE PRODUCTION FOR WEEK

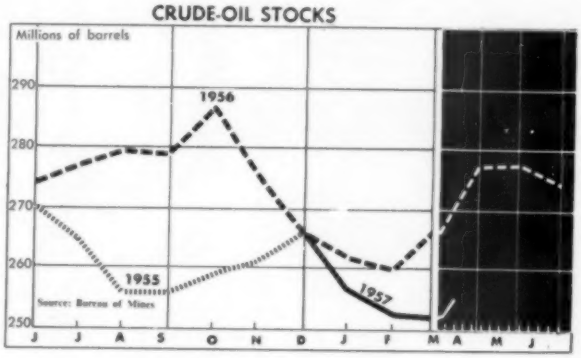
	April 20, 1957			Apr. 13
	Crude oil	Lease condensate	Total	total
Alabama	11,825	.....	11,825	11,700
Arkansas	83,325	300	83,625	83,550
California	930,000	.....	930,000	931,100
Colorado	153,200	.....	153,200	153,400
Eastern	50,200	.....	50,200	50,600
Florida	1,225	.....	1,225	1,225
Illinois	229,400	.....	229,400	226,500
Indiana	31,100	.....	31,100	31,900
Kansas	†351,000	.....	†351,000	†298,300
Kentucky	47,700	.....	47,700	47,400
Louisiana	878,000	74,400	952,400	952,650
North	129,000	2,900	131,900	132,150
South	749,000	71,500	820,500	820,500
Michigan	28,500	.....	28,500	27,900
Mississippi	110,050	4,900	114,950	114,950
Montana	72,950	.....	72,950	72,750
Nebraska	53,650	.....	53,650	38,650
Nevada	100	.....	100	100
New Mexico	269,200	5,200	274,400	274,400
North Dakota	37,650	.....	37,650	39,150
Oklahoma	†634,400	.....	†634,400	†602,800
Texas	3,150,000	55,250	3,205,250	3,205,250
Dist. 1	56,000	475	56,475	56,475
Dist. 2	155,000	8,750	163,750	163,750
Dist. 3	444,000	26,300	470,300	470,300
Dist. 4	245,000	6,600	251,600	251,600
Dist. 5	42,000	400	42,400	42,400
Dist. 6	140,000	6,000	146,000	146,000
East Texas field	210,500	.....	210,500	210,500
Dist. 7-B	168,000	75	168,075	168,075
Dist. 7-C	171,000	4,225	175,225	175,225
Dist. 8	1,195,000	1,400	1,196,400	1,196,400
Dist. 9	214,000	700	214,700	214,700
Dist. 10	109,500	325	109,825	109,825
Utah	13,150	.....	13,150	14,600
Wyoming	300,300	.....	300,300	295,250
Others	‡100	.....	‡100	‡100
Total U. S.	7,437,025	140,050	**7,577,075**	7,474,225
Change from previous week, up			**102,850**	.....
Canada	†563,000	.....	†563,000	†477,600

Total U. S. prod.—January 1-April 20 ..... 834,420,375 bbl.

Same period last year (crude plus cond.) ..... *800,998,780 bbl.

*Includes 14,471,700 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

CRUDE-OIL STOCKS



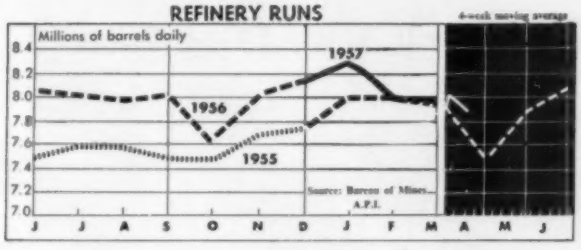
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

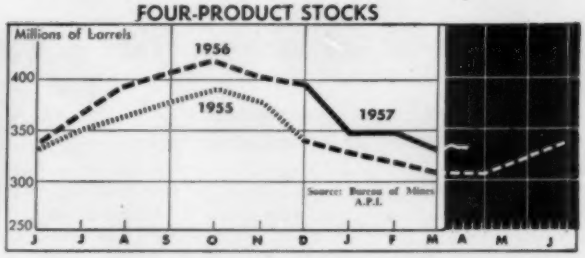
	4-13-57	4-6-57	4-14-56
Pennsylvania Grade	2,642	2,609	2,678
Other Appalachian	1,890	1,916	2,364
Illinois, Indiana, Michigan	9,134	9,334	10,083
Nebraska, North Dakota	2,106	2,002	2,016
Kansas	8,602	9,013	8,093
Oklahoma	22,405	22,636	24,159
Arkansas	2,561	2,491	2,904
Louisiana	18,527	18,283	16,827
North	2,826	2,827	2,619
South	15,701	15,456	14,208
Mississippi	2,257	2,284	2,998
New Mexico	7,277	7,002	8,284
Texas	116,130	113,702	125,289
East Texas proper	10,969	10,869	8,656
West Texas	53,580	52,587	62,431
Texas Gulf	22,047	21,736	22,102
Other Texas	29,534	28,510	32,100
Wyoming	16,223	16,660	16,108
Other Rocky Mountain	6,069	5,919	5,858
California	25,995	25,622	27,821
Foreign	†13,498	12,952	11,603
Total	255,316	252,325	267,085

*Bureau of Mines. †Includes 3,513,000 bbl. in California.

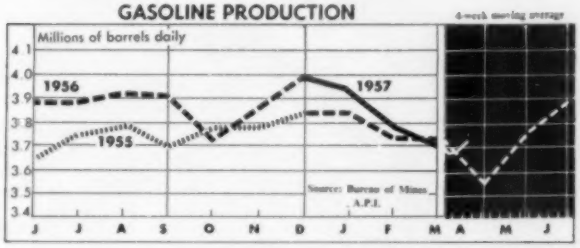
REFINERY RUNS



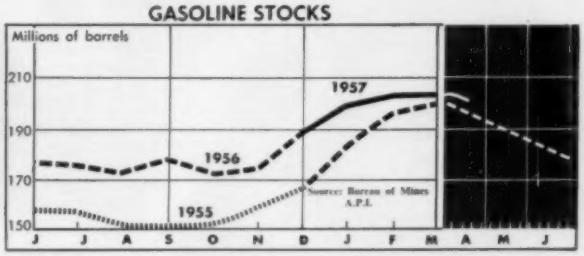
FOUR-PRODUCT STOCKS



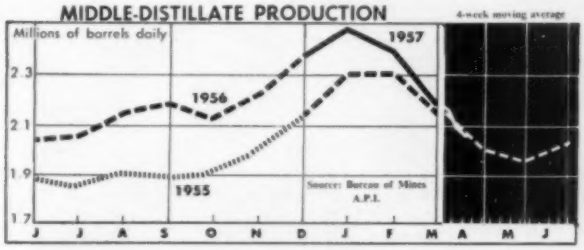
GASOLINE PRODUCTION



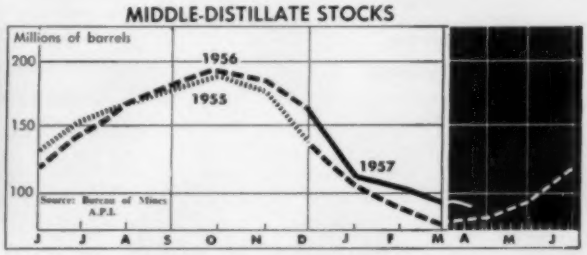
GASOLINE STOCKS



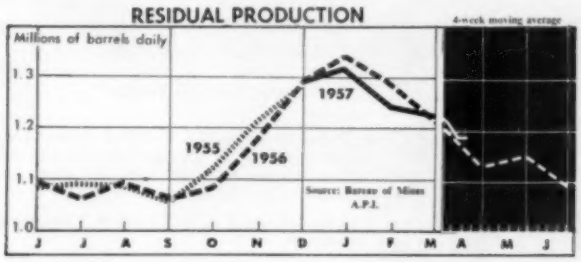
MIDDLE-DISTILLATE PRODUCTION



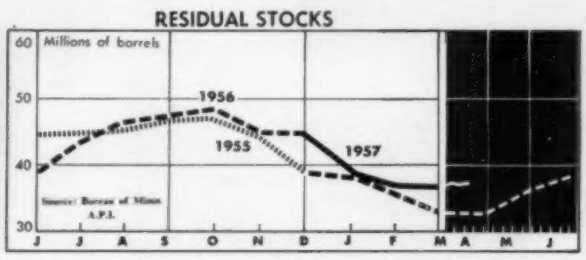
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, APRIL 19, 1957

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, April 1956—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,206	524.7	37.1	297.6	235.3	42,610	8,039	22,209	8,755	1,027	417.0	30.2	285.3	196.1
Appalachian:														
District 1	101	41.4	6.7	18.9	14.0	5,196	417	1,669	510	94	36.5	4.3	21.5	6.3
District 2	112	48.9	7.4	13.7	14.7	2,983	386	555	335	100	48.7	6.4	15.7	14.0
Ind., Ill., Ky.	1,239	659.6	66.6	260.6	153.8	37,353	3,486	10,868	4,646	1,333	674.4	77.0	257.8	172.0
Minn., Wis., Dak.	82	38.7	4.1	24.6	6.9	7,120	275	3,087	386	80	37.3	3.7	20.9	5.8
Okla., Kans., Mo.	622	351.7	22.9	128.9	30.1	20,679	854	7,120	838	604	307.5	12.4	141.6	29.5
Inland Texas	248	185.8	8.6	54.4	20.4	8,017	260	1,448	1,693	246	185.2	9.2	46.3	28.3
Texas Gulf Coast	1,904	867.0	78.1	452.8	241.6	27,456	2,800	8,016	4,973	1,958	925.0	93.8	523.8	244.8
La. Gulf Coast	686	361.0	67.0	175.8	64.9	10,956	1,968	4,887	1,400	678	337.1	52.1	161.7	47.8
N. La. and Ark.	60	31.3	2.3	12.7	5.6	4,405	729	1,618	112	60	20.4	1.9	17.8	2.5
Rocky Mountain:														
New Mexico	28	13.3	0.6	5.0	3.4	342	11	81	62	24	12.9	0.3	4.3	3.0
Other Rock Mt.	239	112.1	2.0	58.7	34.0	7,982	241	2,463	1,002	227	103.2	2.2	55.5	32.0
California	1,163	531.6	4.6	202.3	367.4	26,846	313	8,780	12,231	1,056	452.1	5.6	160.7	347.6
April 19, 1957	7,690	3,767.1	308.0	1,706.0	1,192.1	201,945	19,779	72,801	36,943	7,487	3,557.3	299.2	1,712.9	1,129.7
April 12, 1957	7,899	3,760.3	304.9	1,778.7	1,118.3	202,904	19,823	74,156	36,758	.....	.....	.....	.....	.....
April 20, 1956	7,436	3,514.1	292.0	1,711.7	1,168.9	192,933	17,867	61,926	32,829	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipe lines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (88 octane)	11.75-12.25
Premium (96 octane)	13.50-14.00
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	11.00-11.50
Regular (92 octane)	11.25-11.75
Premium (97 octane)	13.00-13.50
Premium (98 octane)	13.25-13.75
California (rack):	
Regular (86 octane)	13.1
Premium (93 octane)	14.1
Premium (96 octane)	15.1
Caribbean area (cargoes):	
Regular (87 octane)	11.00
Premium (93 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	10.00-10.375
Diesel oil (58 d.i. and above)	9.625-9.875
Distillate No. 1	9.625-9.875
Distillate No. 2	9.00-9.375
Gulf Coast (cargoes):	
Kerosine 41-43	10.50-11.00
Distillate No. 2	10.00-10.50
New York Harbor (barges):	
Kerosine 41-43	12.25
Distillate No. 2	11.65
Diesel fuel, 48-52 d.i.	11.95
Caribbean area (cargoes):	
Distillate No. 2	10.00

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude scale (solid in bags or barrels	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max 1% S)	$2.25-2.35
Gulf Coast (cargoes):	
Bunker C fuel	$2.75-3.00
New York Harbor (barges):	
Bunker C fuel	$3.30-3.40
Caribbean (cargoes):	
Bunker C	$2.55
California (rack):	
★ Bunker C fuel, Los Angeles	$2.85-3.00

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	25.5
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	22.25
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	28
200 vis. neutral (180 at 100°), 25 p.t.	26

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.67	....	....	....	....
15-15.9	2.71	....	....	....	$1.89
16-16.9	2.74	....	....	....	1.94
17-17.9	2.78	....	....	....	1.99
18-18.9	2.82	....	....	....	2.04
19-19.9	2.85	....	....	....	2.09
20-20.9	2.89	$2.75	....	$2.62	2.14
21-21.9	2.93	2.77	....	2.64	2.19
22-22.9	2.97	2.79	....	2.66	2.24
23-23.9	3.01	2.81	$3.44	2.68	2.29
24-24.9	3.05	2.83	3.46	2.70	2.34
25-25.9	3.09	2.85	3.48	2.72	2.39
26-26.9	3.13	2.87	3.50	2.74	2.44
27-27.9	3.17	2.89	3.52	2.76	2.49
28-28.9	3.22	2.91	3.54	2.78	2.54
29-29.9	3.27	2.93	3.56	2.80	2.59
30-30.9	3.32	2.95	....	2.82	2.63
31-31.9	3.38	2.97	....	2.84	2.67
32-32.9	3.44	2.99	....	2.86	2.71
33-33.9	3.50	3.01	....	2.88	2.75
34-34.9	3.56	3.03	....	2.90	2.79
35-35.9	3.61	3.05	....	2.92	2.83
36-36.9	3.65	3.07	....	2.94	2.87
37-37.9	3.68	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40 and up	....	3.15	....	3.02	2.95

*Includes Oklahoma, part of Kansas, North Dakota, West Texas (sweet) and North Central Texas. †Low Cold test Gulf Coast. ‡Sour.

Effective dates: California January 17, 1957, east of California, January 3-January 10, 1957; Pennsylvania Grade, January 16, 1957.

Some crudes in North Central Texas and West Central Texas, are on the intermediate schedules.

FLAT PRICES

Louisiana:	
Bienville (distillate)	$3.05
Ville Platte	3.45
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.88
Middle District	4.70
Southwest Pennsylvania	4.41
West Virginia	4.23
Buckeye Grade	4.23
Zanesville Grade	3.27
Illinois Basin	3.15
Canada:	
Leduc-Woodbend	2.78
Redwater (Alta.)	2.67
Smiley (Sask.)	2.44
Pembina	2.65

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 40°-40.9°, Puerto La Cruz	3.37
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26.5°-26.9°, Amuay*	2.55
Quiriquire, 16.5°-16.9°, Caripito	2.45
Lagunillas heavy, flat, Amuay or Las Piedras*	2.38
Bachaquero, flat, Las Piedras*	2.23

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.87
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.69
Iraq, 36.0°-36.9°, Tripoli, Banias	2.69
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES PER LONG TON

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Gulf-U.S.N.H., clean (USMC+15%)	$3.28
★ Gulf-U.S.N.H., dirty (USMC flat)	2.85
★ N.W.I.-U.S.N.H., dirty (USMC—15%)	2.30
★ Gulf-France, clean (USMC flat)	7.65
P.G.-U.S.N.H., dirty (USMC+5%)	13.34
★ P.G.-Japan, dirty (USMC+7.5%)	9.68

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HEAVY DUTY 19' all steel tandem oilfield bed with Braden M30-144 winch, complete. Grant rolling tailboard and Texas poles. Priced to sell. Edd Noland, Box 229, Phone 102, Chanute, Kansas.

NEW ¾" HPR-10 and HPR-20 Cast Bronze Reliance Regulators. Excess from construction. Priced to sell. Write for full details. Southeast Alabama Gas District, Box 271, Andalusia, Alabama.

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Electrically operated, of the following specifications:

Chicago Pneumatic Simplate Valve Gas Compressor, Serial No. 55045.
Size 12—12 x 7 Y D E
Direct connected to Allis-Chalmers Induction Motor NENA
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Offers should be directed to the

SCRANTON SPRING BROOK WATER SERVICE COMPANY
38 North Franklin Street
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Unit can be inspected at the Generating Plant of the
SUNBURY GAS WORKS, Sunbury, Pa.

BARGAIN PRICE

New 222—4½" OD x 2⅛" Bore Hinderliter API Full Hole Rotary Tool Joints for 3½" OD API Internal Upset Drill Pipe.

CONTACT

EL PASO NATURAL GAS COMPANY,

c/o C. L. Klepper, Phone 2-7781 through May 4, KEystone 2-2911 May 5 and after, Box 1492, El Paso, Texas.

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COMPLETE PIPE-THREADING shop. Two Landis machines 13⅜" and 7", with building, fully equipped. Bargain. Phone Diamond 3-0563. Lundquist, Box 1215, Tulsa, Oklahoma.

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FOR SALE EQUIPMENT

3 ELECTRIC Generating Sets, each consists of E. M. Company 175 KW, 219 KVA, 900 RPM, 3 phase, 60 cycle, 480/830/960/1160 volt generator, direct coupled to Waukesha 6-L ROU engine, all skid mounted. Good condition. Located at Lance Creek, Wyoming. The Carter Oil Company. Contact Mr. J. L. Wible, Box 901, Billings, Montana.

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127' LEE C. MOORE MAST—Series #127—5 Sheave Crown, Bolt Type with 4' and 3' Substructures. In excellent condition.
UNIT 10 DRAW WORKS with Air, Series 81, Compound and Drilling Line.
8x10 MUD PUMP with Model U9 International Motor—also equipped with 3" Bronze Liners for Salt Water Disposal Pump.

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2—Upshot heaters, 10 mil. BTU/hr.
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2—12' x 45' Butane Tanks, 125#
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1—14' x 21' Clay Tower, 125#
1—8' x 75' Tower, 20 Trays, 25#
1—18" x 32' Tower, 15 Trays, 160#
2—8½' x 23' Tanks 80#
5—Packed Towers 14" x 40', 18" x 23', 160# Wyatt 1950.
1—Poly Reactor, 550#, 24" x 28'.

HOT-OIL PUMPS

3 Pacific ITB, 400 gpm—2,000' hd, 735 gpm—3,100' hd.
5 Pacific 5VTB, 612 gpm—600' hd, 324 gpm—480' hd, 308 gpm—516' hd, 193 gpm—389' hd.
1 Pacific HVTB (unused) 1270 GPM—408' Hd.
8J hot oil pump 3 x 9, 13 st, 325 gpm, 4600' hd.

HEAT EXCHANGERS

4—Kellogg Adm. Ftg. Hd. 2200, 1300 Sq. Ft., 315#
4—Kellogg Stel Ftg. Hed. 800, 650, 500 Sq. Ft.
18—GR Fin Tubes, 73 Sq. Ft.
6—Brown fintube exchangers, 300# 140 Sq. Ft. 4-6 chrome.
5—Steel 1,000, 900, 800, 600, 500 Sq Ft.
6—Adm. 785, 742, 425 Sq. Ft.
30—304 SS shell & tube condensers 100-1000 Sq. Ft.

COMPRESSORS

1 Worth LTC-6 800 hp.
3 Penn Comps 100 CFM 500 lbs.
385 CFM 160 lbs.

MISCELLANEOUS

8—Bird Centrifugals 32 x 50, 24 x 38, 18 x 28.
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FOR LEASE OR SALE—Truck mounted rotary drills, water tanks, air compressors. Telephone TAylor 7-3216, Dallas, Texas, Walters Drilling Company.

32 DRILL COLLARS, 20 ft. OD, 5", ID 2 in., 41-40 heat-treated steel, BRAND NEW. $300 each. Ask for Ralph Varel. FL 1-6487, Varel Mfg. Co., 9230 Denton Dr., Dallas.

C-34 WALKER-NEER Spudder, with or without 5-7 tools. A-1 condition. Fully equipped. Located at Drumright, Oklahoma. Box 788 or phone 20, Drumright.

GAS METERS FOR SALE: Foxboro and Westcott Orifice Meters. Large Stock of Late Types and in Good Condition. George Milner, Box 124, Okmulgee, Okla.

CLARK BROTHERS—Model HMA6 angle unit complete with Young cooler and all fittings. Six power cylinders 8¼ x 8¼, 265 hp at 600 rpm. Gas cylinders, two 14½ and one 10½. Capacity 1,500,000 CFD at 0# suction. Practically new condition immediately available and priced at a bargain.

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Complete rotary drilling rig. U-15 drawworks powered by 3—NKU Waukesha engines. Late style 133' Oilwell derrick with 7' 8" Oilwell substructure. 7¼" x 14" Oilwell 214-P mud pump. Double Shaffer blowout preventer. Drill pipe and drill collars are also available with this rig making it ready to move on location.

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For further information concerning this equipment call

HENSON DRILLING COMPANY,
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4 BEVELING MACHINES, late type complete with torches up to 8", $250.00 each. Redneb Pipe Co. P. O. Box 1798, Shreveport, La. Phone 4-7767.

WILSON GIANT Roadair Drawworks with 36" Hydromatic, 2—L3000 LeRoi engines, single pump compound, catheads, air compressor, etc. Completely overhauled. Top A-1 condition. Also 64E Oil Well drawworks with 36" Hydromatic, pump compound, catheads, 2—8 cyl. LeRoi engines. Both units reasonably priced. Liberal terms to responsible party. Rig Supply & Rental Co., Box 2406, Casper, Wyo. Phone 2-5870.

PRICED TO SELL. Cardwell RL Spudder, rated 7500' drilling, powered Waukesha 200 HP engine, good cables. Pressey & Son, Pueblo, Colo.

BESSEMER GAS COMPRESSORS—3 type 10 twins direct connected units—Boswell-Frates Company, 1003 Kennedy Building, Tulsa, Oklahoma.

SMALL FAILING rotary or coring drill. Truck-mounted, with pump, some equipment. Reasonable. Contact: Bob's Carter Service, 1325 First Avenue North (Phone 9-0848) Billings, Montana.

FOR SALE

One good used skid mounted Gardner-Denver Compressor, Mod. 425 DD rated 1000 MCF per day at 300# suction—1000# discharge with 145 GK Waukesha. Contact Drew Cornell, Inc., Box 1267, Lafayette, Louisiana.

OR WILL TRADE FOR FOLLOWING:

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One good used skid mounted Compressor—rating 5,000 MCF per day at 300# suction and 1000# discharge. Contact

DREW CORNELL, INC.
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1—BS&B 40 CAR— Double Track— Safwalk Loading Rack

complete, slightly used, dismantled, excellent buy, cost today $9500.00, priced to sell, $1500.00.

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Your Inspection Is Invited. Write for Catalogue.

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COMPLETE carload ethyl plant dismantled and ready to load. Bargain price. Box 1858, W. C. Berry, Tulsa, Okla.

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FOR SALE: 1—50 H.P. 72" Stroke Twin Crank Parkersburg Pumping Unit, with 60 H.P. 4-Cylinder Waukesha Engine. 1—50 H.P. 74" Stroke Twin Crank O.C.S. Pumping Unit with 6MCAU Waukesha Engine. 1—#TC-33-22E 29 H.P. 54" Stroke Twin Crank Lufkin Pumping Unit with VIKU Waukesha Engine. 2—D-80 16.8 H.P. 48" Stroke Twin Crank American Pumping Units with ZC-346 Fairbanks-Morse engines. Overton Supply Co., Overton, Texas.

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WANT 36L or 32 SPECIAL Walker-Neer on rental-purchase basis. Rig must be in top condition for major company operation. Semi-trailer mount, 5" and 7" tools for 3000 ft. drilling and workover. We can offer excellent opportunity to anyone caring to dispose of their rig on a one year payout basis. State price, terms you want, and location where rig may be inspected. Deal only with principals. Box K-149, The Oil and Gas Journal, Tulsa, Oklahoma.

11½" or 12" bore x 12" stroke cylinder complete with piston for model SVG-10 Ingersoll-Rand angle type compressor.

CARSON MACHINE AND SUPPLY COMPANY

Oklahoma City, Okla. Great Bend, Kans.
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HELP WANTED

ESTABLISHED, well-regarded oilfield equipment manufacturer desire the services of Petroleum or Mechanical Engineer to head product development program. Must have talent for design and ability to conceive and develop new ideas. Major oil company experience desirable. Good opportunity for right man. Salary open. Please give full information. Replies held in strictest confidence. Box K-131, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEERS WANTED: By crude oil pipe line operating company for general engineering. Applicants not over 30 years of age and must have a recognized degree in engineering from an accredited engineering school. Experience not essential. Salary based on experience and qualifications. When making application, please furnish resume of experience record, personal data, and copy of college transcript. Reply to EMPLOYEE RELATIONS DEPARTMENT, Interstate Oil Pipe Line Company, P. O. Box 1107, Shreveport, Louisiana.

GEOPHYSICISTS

CALTEX has openings in Central Sumatra for candidates capable of supervising geophysical crews who can meet the following qualifications:

- Degree in Geology or Physics
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Salary commensurate with background and qualifications. Liberal allowance and benefit plans.

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Well qualified chief accountant with oil accounting, I.B.M. and tax experience needed by active independent oil company in Houston. C.P.A. qualifications desirable, good salary, opportunity for advancement. Replies treated confidentially.

Box K-138, The Oil and Gas Journal, Tulsa, Oklahoma.

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Must be thoroughly familiar with pricing and specifications and have wide acquaintance. To be located in Mid-Continent area. Good opportunity for right man. State age, experience and starting salary expected. All replies will be kept strictly confidential.

Box K-129,
The Oil and Gas Journal,
Tulsa, Oklahoma.

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Reservoir Engineer opening in New York Office for graduate engineer with minimum of 2 years experience in reservoir work. Prefer B.S. or M.S. in petroleum, geological or chemical engineering.

Work is associated with operations in Eastern Hemisphere and will require occasional business trips abroad. Initial salary commensurate with qualifications. Good opportunity for future advancement.

Send detailed resume covering personal data, academic achievements, experience summary and salary requirements to:

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380 MADISON AVENUE
NEW YORK 17, NEW YORK
Attn.: Personnel Dept.

HELP WANTED

DISTRICT GEOLOGIST: Established independent desires geologist experienced in all phases of petroleum exploration, must have chief geologist qualifications. State salary and resume. Box K-145, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEERS—Chemical, Mechanical, Petroleum or Gas Engineering graduates. Major Oil Company will interview applicants for openings in natural gas department. Their area of operations consists of Mid-Continent, Louisiana and Gulf Coast. Salary to suit previous experience. Our employees are aware of this ad. Box K-101, The Oil and Gas Journal, Tulsa, Oklahoma.

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- FOREMAN ELECTRICAL, 3 yrs. experience.
- SUPERVISOR, OIL HANDLING, 3 yrs. Must have field experience.
- MUD TECHNICIAN, 1 yr. experience. Age to 32.
- TEACHER-PRINCIPAL, Male. Must have B.S. in education.
- STENOGRAPHER, Male. 1 year experience. Age to 32. Must be single.

All information confidential.

Send complete resume to:
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HELP WANTED

FOREIGN EMPLOYMENT. List oil companies, drilling contractors, seismograph contractors, showing where apply foreign jobs. $5.00 cash. OIML Co., Box 2003, Tulsa, Okla.

PETROLEUM ENGINEER—Large and aggressive oil company has opening for petroleum engineer with three to four years drilling and production experience for Central Kansas District Office. Good opportunity for advancement with company having excellent employee benefits and rapid expanding operations. Furnish resume of experience and education. All replies confidential. Apply Box K-142, The Oil and Gas Journal, Tulsa, Oklahoma.

Medium Sized Construction Company Wants Experienced Construction Man:

Prefer man 34 to 39 years of age, preferably having engineering degree and experienced in estimating refinery, chemical plants and other industrial plant installations. Must be familiar with construction company organization in both office and field. Right man can become key figure in immediate company expansion. Salary commensurate with ability. Location S.E. Kansas.

Box K-146,
The Oil and Gas Journal,
Tulsa, Oklahoma.

Operations Engineer

Independent oil company has opening for petroleum engineer with four to seven years experience both technical and administrative for responsible position in planning and control. Knowledge of operating procedures, some valuation work and practical oil and gas law would be desirable. Excellent growth opportunities. Please furnish complete details on qualifications, including starting salary required.

Box J-987,
The Oil and Gas Journal,
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Management Type Man for Developing Economic and Feasibility Reports on Pipeline Systems.

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Refinery Technologist

If you are a chemical engineer with 3 to 5 years experience in refinery process engineering or operation and economic analysis and have an interest in consulting and technical service type work, you should investigate this unique opportunity to capitalize on your background and to participate in the growth of an expanding technical activity of a well-known company allied to the refining industry. This position offers a wide variety of assignments, industry-wide contacts with refining and process companies, for using initiative and originality to increase responsibility. A midwest suburban location offers ideal professional environment. Send resume of qualifications to

Box K-117,
The Oil and Gas Journal,
Tulsa, Oklahoma.

SITUATIONS WANTED

GEOLOGIST: Desires connection with company or independent, where use can be made of thorough knowledge of Mississippi and surrounding areas acquired through eight years of major company experience. Box K-126, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER: Age 37, twelve years varied engineering, geological, drilling and production and supervisory major company experience. Desires responsible position in some phase of oil industry. Presently employed. Box K-135, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION SUPT.-Drilling Engr. for large Drilling firm, 11 years prior major oil company experience desires affiliation with aggressive Independent. Registered Petroleum Engineer. West Texas, West Coast or Rocky Mt. area preferred. Box K-136, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST: Desires affiliation with aggressive independent or small company offering opportunity for financial improvement and for the experience. B.S. degree, 10 years diversified exploration experience in Texas, Oklahoma and Louisiana. Currently employed. Age 34, married. Reply P. O. Box 2075, Dallas, Texas.

DISTRICT GEOLOGIST: Successful oil-finding record, 33, M.S., 9 years varied surface, subsurface, geophysical and development experience in Western United States and Gulf Coast. Employed by Major. Desires responsible oil-finding position with Independent. Box K-141, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, 33, B.S. Degree, married, seven years broad experience in production, drilling, workovers, evaluation. Desires permanent position with good opportunity in substantial organization. Presently employed as production manager for independent producing company in Tulsa. Box K-147, The Oil and Gas Journal, Tulsa, Oklahoma.

AGRONOMIST AVAILABLE. Bachelor of Science—Chemistry, 1949; Master of Science—Agronomy, 1952; Ph.D.—Agronomy, 1954. Five years experience with Agricultural Experiment station; four in basic agronomic research involving cotton and rice fertilizers; one as soil chemist in charge of fertilizer recommendations for general farm crops. Presently employed as Agronomist and Field Representative for major chemical company. Protestant. Married, 2 children. Age, 31. Would prefer connection in Louisiana or neighboring states. Please address: Agronomist, P. O. Box 276, Shreveport, La.

PETROLEUM ENGINEER-Production Superintendent: 25 years experience in administration, all phases drilling, well completions, production valuation, reservoir analysis. Capable of managing entire operation. Experienced in Oklahoma, Kansas and Texas operations. Desire connection with Independent Operator. Box K-150, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION WANTED

WANTED FOR CASH—Depleted and Marginal Wells for Salvage. Frank J. Black, P. O. Box 150, Phone 107, McPherson, Kansas.

WANT TO BUY—Oil Properties, settled or semi-settled production. 100 to 5,000 barrels daily in Oklahoma and Kansas. Contact Morris Sitrin, 1215 First National Building, Tulsa, Oklahoma.

PRODUCING oil, gas properties, also royalties wanted. Any size, any amount. Complete details in first letter. Box 231, Scarsdale, N. Y.

WANTED: Oil or gas production, any size, prefer, Okla., N. M., Tex., Colo. or Kan. B. Thurston, 1427 Princeton NE, Albuquerque, N. M.

HAVE DEAL FOR: 20 to 500 barrels settled production, also have Kansas block of 500 acres to farm out, will hold 1/8 override and furnish $1,000.00 dry hole money, can operate same. Lewis Short Explorations, Burrton, Kansas.

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NEW KRAFTBILT PLAT SHEETS will solve your plotting problems. Choose from a broad selection of sizes, scales and paper types. Contrasting lines are sharp and clean. Bond, ledger and tracing papers are top quality. Our line is complete! Ask for Bulletin 57-W. Ross-Martin Co., P. O. Box 800-A, Tulsa, Okla.

PRODUCTION FOR SALE

FOR SALE—1/8 working interest. Eighty acres, near Bartlesville, Okla. Two pumping wells. Reasonable. Box K-144, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: White Co., Ill. 1 Producing well. Gross income about $500.00 monthly. 2nd well drilled and cased. Equipment value about $11,500.00. Quick sale $12,800.00. Address 500 S. St. James, Evansville, Indiana. Phone GReenleaf 7-0092.

BUSINESS SERVICE

Delaware Corporations formed and serviced. American Guaranty & Trust Company, P. O. Box 487, Wilmington, Delaware.

SALES AND SERVICE

NEWLY ESTABLISHED West Canadian Sales & Service Company is interested in additional lines or Canadian Representation from U. S. Firms. Write Macro Limited, 10920-88th Avenue, Edmonton, Alberta, Canada.

BUSINESS OPPORTUNITIES

FINANCIAL CONTACTS. Underwriters. Brokers, Private Finders of Capital reached. No shopping. Confidential. FREE ENTERPRISE ASSOCIATES, 617 51st St., Brooklyn, N. Y.

Production - Investment

Proven box office attraction needs investors for TV-Movie Production. 80% of your investment back thru depletion before taxation. Low overhead.

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813 Daniel Bldg., Tulsa.

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OFFERING CHOICE ROYALTIES. You can now make very small investments on income Royalties or those ahead of drilling. A. S. Berry, 520 Wright Bldg., Tulsa, Okla.

LEASE AND DRILLING BLOCKS

WANTED TO SELL—some interest in an Oil & Gas Lease in the Grass-Root area of Craig County, Oklahoma. This Lease joins Production and looks very favorable. You can get in worth the money if you are interested. Write W. P. Horn, Box 216, Coweta or call Phone IV-6-5439, Coweta, Okla. Will be glad to show you the lease on appointment.

AN OIL MAN'S DREAM. 240 acres. Offsets production, 2 sides. 6 probable producing sands to 2820 feet including Wilcox. Only 30 miles NW of Tulsa, just south of Osage County. Splendid Geology & Pipe Line Titles, this 240 acre lease block is ready for the rig. Easy Drilling. Well must start by June 17th, 1957 to drill to Wilcox Sand or 2820 feet. Drill this one and cut out most of dry hole risks. Probable Layton, Skinner, Red Fork, Wilcox Production. Only $8.00 acre & 1/8th Override. $12.00 & 3/64ths, $15.00 acre & 1/2nd override. Don't wait, wire, write, Box K-148, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL, GAS AND MINERAL LEASES available in Dell City area of Hudspeth County, Texas. U. S. Geological Survey Map shows anticlinal axis nearby favorable for oil-gas structure. Am fee landowner of over 2000 acres. Write quickly to: Jefferson G. Smith, 215 Littlefield Building, Austin 15, Texas.

OIL LEASES IN BOOMING

4-Corners Area. November Indian Lease sale brought 30 Million Dollars. Some leases sold for $3,200 per acre. Wells estimated up to 1500 barrels of oil per day. Oil Leases from $2.25 an acre. Fortunes being made. Write for free information now. **ATLAS OIL SURVEY, Dept. OJ-5, Colorado Bldg., Denver 2, Colo.**

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VENEZUELAN OIL SCOUTING AGENCY

Reports—maps—newsletter

Cable: VOSA, Caracas
Mail: Apartado 3963
N. VanMiddlesworth
Phone: 54 48 02

EQUIPMENT MEN... in the News

Offshore Representative Appointed by Christensen

Percy Tinsley has been appointed special offshore representative for Christensen Diamond Products Co. As special representative, Tinsley will devote his activities solely to offshore operations, assisting operators in selecting diamond-coring and/or drilling equipment and, when necessary, working with operators to design special equipment to meet unusual problems.

Tinsley has been with Christensen Diamond Products since 1952, and until recently managed its office in Lafayette, La. His new offices will be in Houston.

Standard-Southern Adds Venable to Industrial Sales

Tollie C. Venable has been appointed salesman in the industrial division of Standard-Southern Corp., according to Gerald Rauch, president. Venable formerly was sales representative of The Lunkenheimer Co. He has been in the industrial and construction supply field 20 years.

Standard-Southern is a supplier of pipe, valves, fittings and associated items to oil-field, refinery, industrial and construction firms. General offices are in Houston with warehouse stocks maintained in Beaumont, Houston, and Odessa, Tex. Sales offices are located in Baton Rouge, La., and Dallas and Midland, Tex.

U. S. Steel Supply Names West Texas Representative

G. H. Huffhines is the newly established resident sales representative serving West Texas, according to an announcement by John P. Connor, district manager of United States Steel Supply, warehousing division of United States Steel Corp.

Huffhines, whose headquarters will be at Midland, comes to U. S. Steel Supply from a sister division of U. S. Steel, Oil Well Supply Division. He will cover approximately the western third of Texas, including the Panhandle, North and South Plains, Permian basin, and West Central Texas. He will handle

sales of alloy, carbon and stainless steels. He has been located at Midland since 1953 and joined U. S. Steel in 1956 as drilling equipment sales representative for Oil Well Supply in its district office.

U. S. Steel Supply operates 18 warehouses from coast to coast, including 2 in the Southwest—one at Houston and the other at Dallas.

Mason-Neilan Appoints in Three Field Sales Areas

Robert O. Smith has been appointed New York district manager for Mason-Neilan Regulator Co., division of Worthington Corp. Allan Gilchrist has joined the New York office as a sales engineer.

Additions to the Mason-Neilan Chicago office are Robert Nickerson, transferred from headquarters in Norwood, Mass., and John Mattes, Jr., having newly joined Mason-Neilan as a sales engineer.

On the West Coast, Harry Mattes and David Willardson have been added to the Los Angeles sales engineer staff. Mattes was formerly with Bethlehem Supply Co. and Willardson with C. F. Brown & Co.

These appointments were announced by Carl W. Gram, Jr., vice president.

American Marine Launches Tidewater Marine Vessel

The Kyle Tide, a 136-ft. offshore supply vessel, is in service for its owners, Tidewater Marine Service, following recent launching by its builders, American Marine Corp.

Named in honor of J. E. Kyle, Jr., chairman of the board of directors for Tidewater Marine, the new vessel represents the sixth built by American Marine for the New Orleans firm. Four additional supply vessels are to be built, the next one due for launching by June.

Now on location for Shell Oil Co. out of Morgan City, La., The Kyle Tide has 2,800 sq. ft. of open deck cargo space designed to carry drilling equipment to offshore drilling barges and platforms.

Kinkade Named Manager of New Perfex-Pak Division

H. J. Kinkade has been appointed manager of the Perfex-Pak division of Perfex Corp., Milwaukee, Wis. The new division will manufacture and distribute large air-cooled heat exchangers for industrial and oil-field process cooling, and for the cooling of large engines and compressors, as well as for steam condensing, gas cooling and related services.

Kinkade has had 32 years of experience in the heat-transfer field with Armstrong Cork Co., York Ice Machinery Corp., Fairbanks-Morse & Co., and Young Radiator Co.

Perfex Corp. has been in the engineering and manufacture of heat-transfer equipment 46 years.

Rockwell Acquires Republic Flow Meters

Rockwell Manufacturing Co. has acquired the assets of Republic Flow Meters Co. of Chicago, Willard F. Rockwell, Jr., president of the Pittsburgh firm, has announced.

Republic manufactures electronic and pneumatic instruments and process control equipment for the automatic measurement and control of flow for the electrical, petroleum, natural gas, steel and chemical industries. Republic manufacturing operations are centralized at Chicago, with sales offices or branches throughout the country.

Present management of Republic will remain unchanged, with James D. Cunningham, founder of the company, continuing as president. W. F. Crawford, president of Edward Valves, Inc., a Rockwell subsidiary, will be associated with the Republic management at Chicago.

Republic's Chicago facilities brings the total number of Rockwell manufacturing plants to twenty-three.

Birdwell Extends Service In Kentucky and Indiana

A new service for oil and gas-well production industries in western Kentucky and southern Indiana has been established by Birdwell, Inc., in Henderson, Ky. The company is equipped for electronic surveys and services in all kinds of well completions in oil and gas fields during primary production and secondary recovery.

The new station is the company's eleventh. Others are located in Bradford, Pa.; Parkersburg, W. Va.; Wooster, Ohio; Paintsville, Ky.; and in Illinois and Oklahoma fields.

Garrett C. Campbell is station manager in Henderson. He has had 5 years' experience in Bradford, Parkersburg, and Robinson, Ill., from which location he was recently transferred to Henderson. The equipment in Henderson will be operated by Gordon L. Vest and Luther Long, also formerly of Robinson.

McCullough Names Hester Assistant to the President

H. E. HESTER

The appointment of Harry E. Hester as executive assistant to the president has been announced by I. J. McCullough, president of McCullough Tool Co. Hester will aid the president in all phases of company operations. Hester joined McCullough as sales engineer, later served as purchasing agent, and since 1944 as export and personnel manager, Pacific and Mountain divisions. For 7 years prior to joining McCullough, Hester was with Grant Oil Tool Co.

Wolverine Names Wessels To Southwest Sales Post

Del E. Wessels has been appointed technical sales representative in the Oklahoma and North Texas areas, according to C. T. Fuller, southwestern district sales manager for Wolverine Tube, division of Calumet & Hecla, Inc.

Wessels has had varied experience in the design and rating of heat-transfer equipment. Formerly technical office sales representative in Wolverine's general sales office, Detroit, Wessels will contact petroleum, petrochemical and chemical companies plus heat-exchanger manufacturers and fabricators in that area. He will headquarter in Wolverine's Houston office.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington, D. C. Notice is hereby given that 78.14 acres of land within the known geologic structure of the Madison Township Field, undefined, Licking County, Ohio, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 1:00 P.M., E.S.T. May 1, 1957 when bids will be opened. Details of the lease offering, description of the land, how and where to submit bids, and bid forms may be obtained from the Manager, Eastern States Land Office, Bureau of Land Management, Washington 25, D. C., H. K. Scholl, Manager.

Pipeline Patrol

(Continued from page 226)

Project: Sponsoring 485 miles of 8, 10, 12-in. from Cadiz to Zaragoza, Spain.

Contractors: Prime contractor — **Brown-Raymond-Walsh; Merritt Chapman & Scott, Benson & Montin** of Oklahoma City, **Agroman Construcion Co.** of Spain.

Foreign Natural-Gas Pipelines

Andes Pipeline Corp. (Subsidiary of Glenn McCarthy, Inc.)

Project: 500 miles of 12-in. from McCarthy's Bolivian concession to the Chile copper-mining area.

Status: Proposed.

Contractor: Will do own work.

• **Attock Oil Co.**

Project: 60 miles of line from Dhulian field to Rawalpindi in West Pakistan.

Status: Planned.

Cia. Shell de Venezuela.

Project: 177 miles of 20-in. from La Paz field in the Maracaibo district, to the Cardon refinery on Paraguana Peninsula, to fuel refinery furnaces.

Status: Under way.

Contractor: **Williams Brothers Co.**

Completion: 1957.

• **Empresa Nacional Del Petroleo.**

Project: 80 miles of 10-in. from Concon to Santiago, Chile.

Status: Planned.

Gaz de France

Project: 550 miles of 16 to 24-in. from Lacq field, southwestern France, to Paris, plus a 10-in. lateral to Nantes and 12 to 16-in. laterals to Lyons, making a 1,000-mile system.

Status: Right-of-way work under way.

Contractor: Being handled by French contractors.

Completion: First stage in 1958; complete system in 1960.

Petroleos Mexicanos

Project: 130 miles of 22-in. to parallel a 14-in. line from Reynosa to Monterrey in northern Mexico.

Sui Gas Transmission Co.

Project: 217 miles of 16-in. from Sui gas field to Moultan, Pakistan.

Status: Under way; to be extended later to Lahore with branches at Kot Addu, Jhang Magiana, and Montgomery.

Contractors: **Pakistan Constructors,** a joint company of **Morrison-Knudsen** of Boise, Idaho, and **William Press, Ltd.,** of London.

Project: 145-mile line from Sylhet to Dacca, East Pakistan.

Status: Under consideration. If approved construction could start December 1958.

Technical Office of Hydrocarbon, Ministry of Mines and Petroleum, Government of Venezuela.

Project: 207 miles of 26-in. from Anaco fields to Caracas.

Status: Under way.

Contractor: **Fulghum Contracting Corp.** will be consultants; **Petrogas, S. A.** will engineer and construct the line.

Completion: Spring 1959.

Union of Soviet Socialist Republic.

Project: 900 miles of 26-in. from Stavropol in the Northern Caucasus to Moscow. The line, larger than Russia's other two major gas lines which are only 16 and 18-in., will serve Voroshilovgrad, Voronezh, Tula, Yelets, and Serpukhov.

Status: Under way; over 50 per cent completed.

• **Yacimientos Petroliferos Fiscales (Argentina)**

Project: 1,056 miles from Campo Duran to Buenos Aires.

Status: Proposed. Bids will be taken beginning the end of January 1957.

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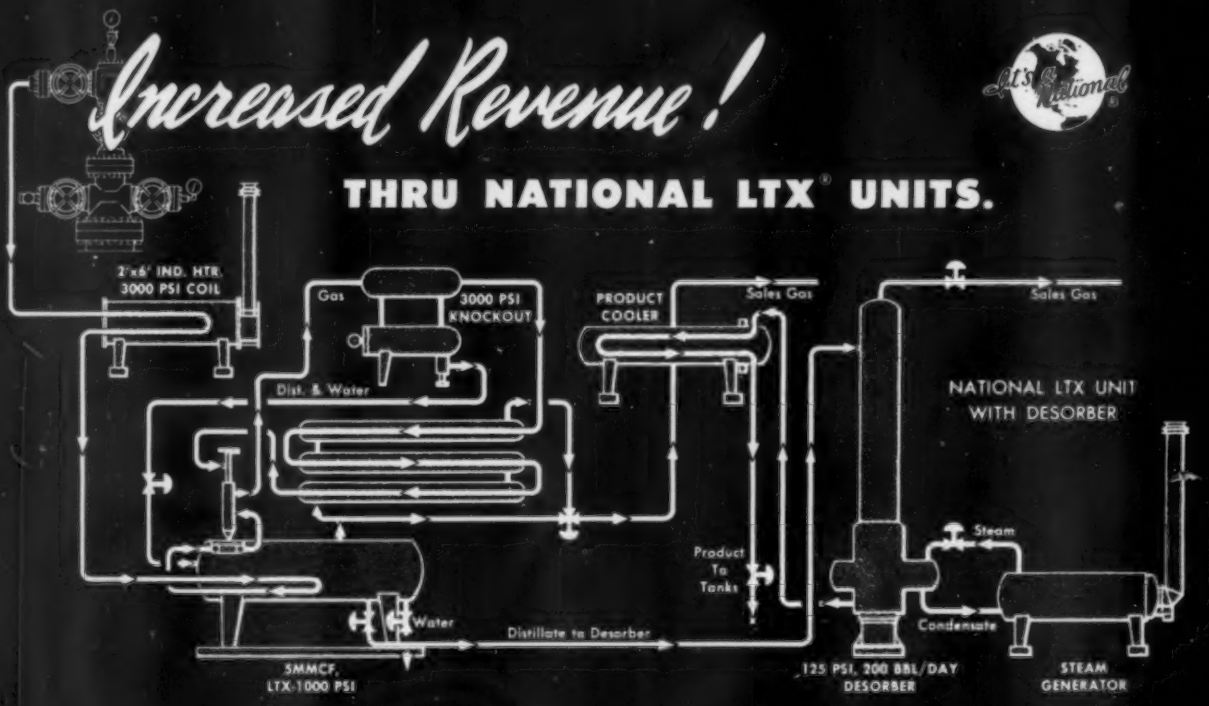

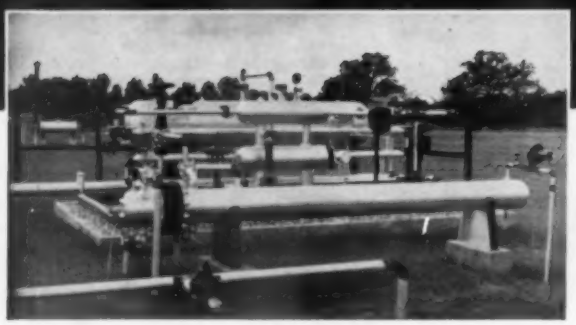

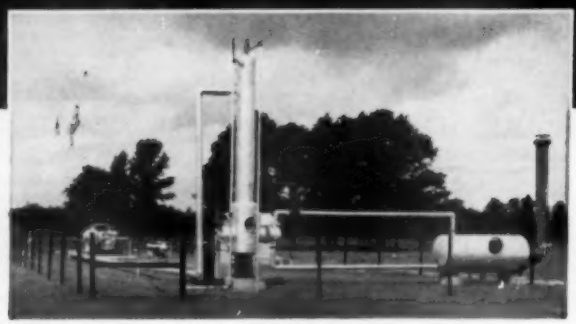

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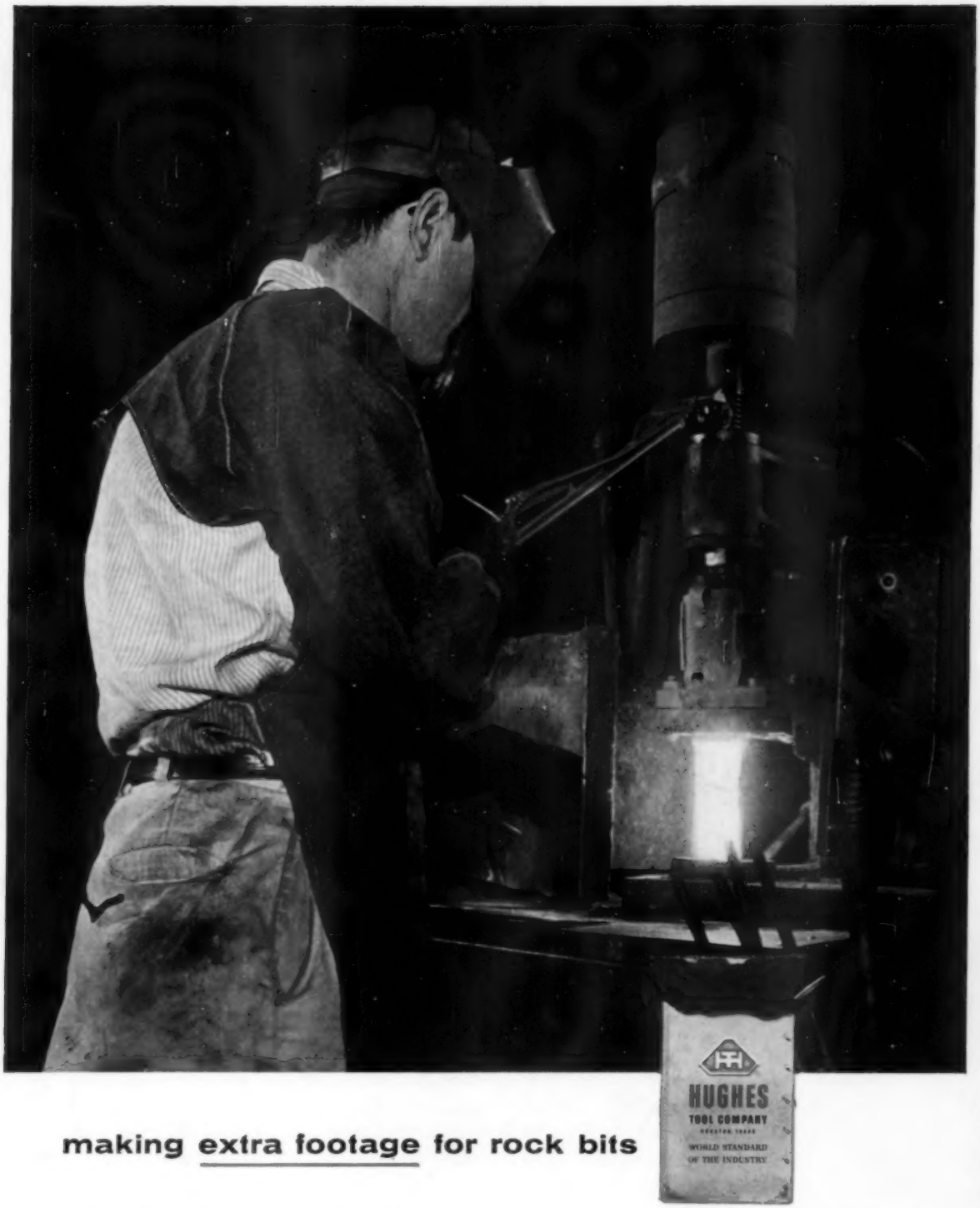

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